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Infrastructure to Application Information Exposure
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Abstract

This document describes the scenarios that applications can use the network layer especially the network routing system exposed information, so as to optimize application layer traffic. The use cases in this document include the ISP broadband network (using P2P and CDN as examples) and the data center network. This document also describes what information should be collected for ALTO service for traffic optimization.

Status of this Memo

This Internet-Draft is submitted in full conformance with the provisions of BCP 78 and BCP 79.

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1. Introduction

ALTO provides an interface to applications and appropriate information to guide an optimal node selection when there are more than one application node providing the same service, through aggregated network map and cost map. It usually aggregates network locations into PIDs, and assigns lower cost value for a PID pair that are topologically closer. So when application node follows the advice from ALTO server to choose one resource provider within a PID that has lower cost from its own PID, with higher probability the application node can keep the content request and response traffic flow intra domain. This can reduce interdomain traffic for ISPs, and avoid the congestion in the backbone network. More factors for node selection can be considered, such as pricing, congestion, and etc.

In order to assure optimality, the underlying infrastructure needs to expose its topology information, node/link status information, pricing information for path selection to ALTO server, which will either be abstracted as the network map or as the impacting input factor of cost map.

2. Terminology

I2AEX: Infrastructure to Application Exposure.

ALTO: application layer traffic optimization.

IaaS: Infrastructure as a Service.

3. Use Cases

3.1. ISP network

ISP broadband networks are consisted of interconnected autonomous systems. They run BGP protocols between the boarder gateway routers, and run IGP protocols intra autonomous systems. There are core routers, and access routers (BRAS) which fullfill the admission control through RADIUS servers, the access router connects to multiple aggregation switches. And an aggregation switch connects to multiple DSLAMs or OLTs. And the DSLAM or OLT connect to the home gateways or ONUs, which connect to the user devices. [It's better to give a figure here.]

The ISP network usually hide all its information to applications. But in the trend of big traffic use case, the main motivation is to reduce the backbone and interdomain traffic. CDN and P2P are the two

target applications. In a P2P application, the content requester requests contents from peers in the same swarm. It may choose a peer that is far way ignoring a peer that is topologically closer to it. Due to the topology ignorance, the application may creates unnecessary backbone and interdomain traffic.

In another application of CDN, a popular resource usually is stored in multiple data centers. Without the knowledge of the network topology, the CDN's DNS server can redirects the content requester to a sub-optimal edge server, which is not always topolocially close to the content requester. Even with measuring the round trip time between its edge servers and the requester's local DNS server, it may not get the accurate result because RTT is dynamic and user can specify its own DNS server.

For the above two broadband network use cases, the infrastructure information from the home to the access router does not help much. But more attendtion should be paid to the information from the access router to the routing system, which can provide important input for the ALTO maps. An ALTO server needs the following information as input:

o The network segments information. Every access router manages one or more IP address pools, to be assigned to the users through DHCP or other ways.

o The IP addresses of the interfaces of routers, and the routing table information(IGP or BGP). This information can help to construct the whole network topology.

o The congestion status of the router interfaces, but this information could be reflected in the routing table change.

o Policy information. For example, one multi-homing AS prefers to use which AS to transit its traffic, including the pricing information.

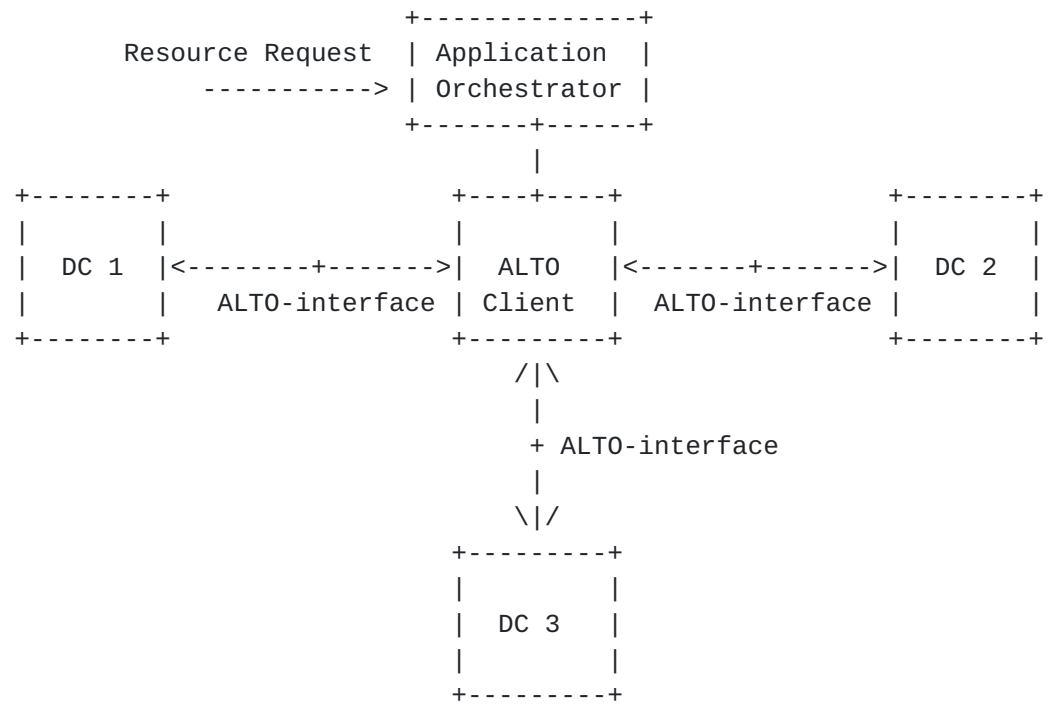
ALTO can use the collected information mentioned above to be able to select a node topologically closer, with lower transit price and less congested link.

3.2. Data Center Network

Infrastructure as a service (IaaS) is a way how the data center provides its services. There are different kinds of resources in a data center, physical machines, virtual machines, switches, firewalls, computing power, storage space, and electric power. [I-D.lee-alto-ext-dc-resource] proposes collecting data center resource information to make use of such information for a key

decision to allocate the application request to an "optimal" Data Center location in which to host the application request. Key constraints in this decision include resource availability (e.g., memory, storage, CPU, etc.), DC network cost, DC network resource constraints (e.g., bandwidth), structure constraints (e.g., Data Center power consumption) and others.

Combined computing and network resource optimization is of value to both application owners and data center operators. For example a data center operator with multiple buildings in a metropolitan area may also want to balance compute and network costs.



The ALTO server needs to collect the following information so as to provide this kind of service.

o All switches' network capacity information

o All physical servers' information(CPU, memory) in the data center

o The storage space information in the data center

o The physical links information

o The virtual machines' information(CPU, memory) and its affinity

o Pricing models

Based on the aforementioned information, ALTO server can provide the load balancing/traffic optimization information to ALTO client for data centers, through map or ranking.

4. Open Discussion

In order to optimize the application traffic, network layer needs to provide necessary information to the according applications in the previous section, with a method (request/response, or subscription/ notification) to make the underlying information changes be timely sent to the ALTO server. This requires more interactions between the network layer and the application layer. I2RS seems to consider more configuration use cases such like policy based routing, but what ALTO protocol needs is the part that discloses the network information. So there could be two ways to go forward.

(1) Defining a new protocol to cover all required functions such as configuration and information disclosure required by I2RS. This protocol covers ALTO's south bound information requirements on network topology, with its one component. But this protocol will be tremendously complicated. It will be related and overlapped with other existing protocols, such like NetConf and YANG.

(2) Defining the south bound interface for ALTO, to collect the infrastructure information, and bring the requirements discussion in I2RS, and identify the final scope, to avoid the overlap between different WGs(ALTO, NetConf, NetMod). In this case, the protocol development will belong to ALTO WG.

5. Informative References

[I-D.lee-alto-ext-dc-resource]
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[RFC5693] Seedorf, J. and E. Burger, "Application-Layer Traffic Optimization (ALTO) Problem Statement", RFC 5693, October 2009.

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