                              ALTO for LMAP
                        draft-seedorf-lmap-alto-00

Abstract

   In the context of Large-Scale Measurement of Broadband Performance
   (LMAP), measurment results are currently made available to the public
   either at the finest granularity level (e.g. as a list of results of
   all individual tests), or in a very high level human-readable format
   (e.g. as PDF reports).

   This document argues that there is a need for an intermediate way to
   provide access to large-scale network measurement results, flexible
   enough to enable querying of specific and possibly aggregated data.
   The Application-Layer Traffic Optimization (ALTO) Protocol, defined
   with the goal to provide applications with network information, seems
   a good candidate to fulfill such a role.

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

   Recently, there is a discussion on standardizing protocols that would
   allow measurements of broadband performance on a large scale (LMAP
   [I-D.schulzrinne-lmap-requirements]). In principle, the vision is
   that "user networks gather data, either on their own initiative or
   instructed by a measurement controller, and then upload the
   measurement results to a designated measurement server."

   Apart from protocols that can be used to gather measurement data and
   to upload such data to dedicated servers, there is also a need for
   protocols to retrieve - potentially aggregated - measurement results
   for a certain network (or part of a network), possibly in an
   automated way. Currently, two extremes are being used to provide
   access to large-scale measurement results: One the one hand, highly
   aggregated results for certain networks may be made available in the
   form of PDFs of figures. Such presentations may be suitable for
   certain use cases, but certainly do not allow a user (or entity such
   as a service provider) to select specific criteria and then create
   corresponding results. On the other hand, complete and detailed
   results may be made available in the form of comma-seperated-values
   (csv) files. Such data sets typically include the complete results
   being measured on a very fine-grained level and usually imply large
   file sizes (of result data sets). Such detailed result data sets are
   very useful e.g. for the scientific community because they enable to
   execute complex data analytics algorithms or queries to analyse
   results.

   Considering the two extremes discussed above, this document argues
   that there is a need for an intermediate way to provide access to
   large-scale network measurement results: It must be possible to query
   for specific, possibly aggregated, results in a flexible way.
   Otherwise, entities interested in measurement results either cannot
   select what kind of result aggregation they desire, or must always
   fetch large amounts of detailed results and process these huge
   datasets themselves. The need for a flexible mechanism to query for
   dedicated, partial results becomes evident when considering use cases
   where a service provider or a process wants to use certain
   measurement results in an automated fashion. For instance, consider
   a video streaming service provider which wants to know for a given
   end-user request the average download speed by the end user's access
   provider in the end user's region (e.g. to optimize/parametrize its
   http adaptive streaming service). Or consider a website which is
   interested in retrieving average connectivity speeds for users
   depending on access provider, region, or type of contract (e.g. to be
   able to adapt web content on a per-request basis according to such
   statistics).

This document argues that use cases as described above may enhance
the value of measurements of broadband performance on a large scale
(LMAP), given that it is possible to query for selected results in an
automated fashion. Therefore, in order to facilitate such use cases,
a protocol is needed that enables to query LMAP measurements results
while allowing to specify certain parameters that narrow down the
particular data (i.e. measurement results) the issuer of the query is
interested in. This document argues that ALTO [RFC5693]
[I-D.ietf-alto-protocol] could be a suitable candidate for such a
flexible LMAP result query protocol.

2. Example Use Cases

    To motivate the usefulness of ALTO for querying LMAP results,
    consider some key use cases:

    o Video Streaming Service Provider: For HTTP adaptive streaming, it
       may be very useful to be able to query for average measurement
       values regarding a particular end user's access network provider.
       For instance, consider a video streaming service provider that
       queries LMAP measurement results to retrieve for a given end-user
       request the average download speed by the end user's access
       provider in the end user's region. Such data could help the
       service provider to optimize/parametrize its HTTP adaptive
       streaming service.

    o Website Front End Optimization: A website might be interested in
       statistics about average connectivity types or download speeds for
       a given end user request in order to dynamically adapt HTML/CSS/
       JavaScript content depending on such information (sometimes
       referred to as "Front End Optimization"). For instance, image
       compression may be employed depending on the average connectivity
       type of a user in a given region or with a given access network
       provider.

    o Troubleshooting: In general, any service on the Internet may be
       interested in LMAP data for troubleshooting. In case a service
       does not work as expected (e.g. low throughput, high packet loss,
       ...), it may be of value for the service provider to retrieve
       (fairly) recent measurement data regarding the host that is
       requesting the service.

    o TBD: add more use cases

3. Advantages of using ALTO

    The ALTO protocol [I-D.ietf-alto-protocol] specifies a very
    lightweigth JSON-based encoding for network information and can play
    an important role in querying the measurement results as we argue in
    Section 2.

    ALTO is designed on two abstractions that are useful here. First is
    the abstraction of the physical network topology into an aggregated
    but logical topology. In this abstract topological view, referred to
    as "network map", individual hosts are aggregated into a well defined
    network location identifier called a PID. Hosts could be aggregated
    into the PID depending on certain identifying characteristics such as
    geographical location, serving ISP, network mask, nominal access
    speed, or any mix of them. The "network map" abstraction is
    essential for exporting network infromation in a scalable and
    privacy-preserving way.

    The second abstraction that is useful for LMAP is the notion of a
    "cost map". Each PID identified in the network map can, in a sense,
    become a vertex in a cost map, and each edge joining adjacent
    vertices can have an associated cost. The cost can be defined by the
    measurement server and can indicate routing hops, the financial cost
    of sending data over the link, available bandwidth on the link with
    bottled-up links increasing showing a smaller value, or a user-
    defined cost attribute that allows arbitrary reasoning.

    The ALTO protocol defines several basic services based on such
    abstractions, but additional ones can be easily defined as extesions.

    There are other advantages to using ALTO as well. The protocol is
    defined as a set of REST APIs on top of HTTP. The data carried by
    the protocol is encoded as JSON. Queries can be performed by clients
    locally after downloading the entire topological and cost maps or
    clients can send filtered requests to the ALTO server such that the
    ALTO server performs the required computation and returns the
    results. The protocol supports a set of atomic constraints related
    to equality that can be used to filter results and only obtain a set
    of interest to the query.

    Additionally, protocol extensions that could also be useful for the
    LMAP usage scenario (e.g. extensions for incremental updates, for
    asynchrounous change notifications and for encoding of multiple costs
    within the same cost map) have been proposed and are currently being
    discussed in the ALTO WG.

4. Examples

   [NOTE: syntax most certainly wrong!]

4.1. Download speeds

   This section shows, as an example, how average download speeds
   measured in a given time interval can be reported. The aggregation
   approach in this case is based on ISP and geographical location. Two
   types of data are reported in this example:

   o data collected from measurements against specific endpoints (e.g.
      active measurements);

   o data collected from all measurements (e.g. passive measurements).

4.1.1. Network map

```
{
  "meta" : {},
  "data" : {
  "map-vtag" : "1266506139",
  "map" : {
    "ISP1-GEO1" : {
      "ipv4" : [ "10.1.0.0/16", 172.20.0.0/16" ]
    },
    "ISP2-GEO1" : {
      "ipv4" : [ "10.2.0.0/17" ]
    },
    "ISP3-GEO1" : {
      "ipv4" : [ "10.3.0.0/16" ]
    },
    "ISP2-GEO2" : {
      "ipv4" : [ "10.2.128.0/17" ]
    },
    "ISP4-GEO2" : {
      "ipv4" : [ "10.4.0.0/16" ]
    },


    .
    .
    .


    "MSMNT-CL1" : {
      "ipv4" : [ "192.168.0.0/30" ]
    },
    "TOTAL" : {
      "ipv4" : [ "0.0.0.0/0" ]
    }
  }
}
```

4.1.2. Cost map

```
   {
     "meta" : {},
     "data" : {
       "cost-mode" : "numerical",
       "cost-type" : "avg-dl-speed",
       "map-vtag" : "1266506139",
       "time-interval" : "2629740",
       "map" : {
         "ISP1-GEO1": { "MSMNT-CL1" : 13.2,
                        "TOTAL" : 10.2},
         "ISP2-GEO1": { "MSMNT-CL1" : 11.4,
                        "TOTAL" : 12.3},
         "ISP3-GEO1": { "MSMNT-CL1" : 13.2,
                        "TOTAL" : 10.2},
         .
         .
         .

       }
     }
   }
```

5. References

5.1. Normative References

   [RFC5693] Seedorf, J. and E. Burger, "Application-Layer Traffic
              Optimization (ALTO) Problem Statement", RFC 5693,
              October 2009.

5.2. Informative References

   [I-D.ietf-alto-protocol]
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              draft-ietf-alto-protocol-13 (work in progress),
              September 2012.

   [I-D.schulzrinne-lmap-requirements]
              Schulzrinne, H., Johnston, W., and J. Miller, "Large-Scale
              Measurement of Broadband Performance: Use Cases,
              Architecture and Protocol Requirements",
              draft-schulzrinne-lmap-requirements-00 (work in progress),
              September 2012.

Appendix A. Acknowledgment

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