Individual Submission   B. Ohlman
Internet-Draft   Ericsson
Intended status: Informational   O. Strandberg
Expires: April 28, 2011   Nokia Siemens Networks
                                                         C. Dannewitz
                                                 University of Paderborn
                                                            A. Lindgren
                                                                   SICS
                                                            R. Maglione
                                                          Telecom Italia
                                                             B. Ahlgren
                                                                   SICS
                                                             D. Kutscher
                                                                    NEC
                                                       October 25, 2010

              Requirements for accessing data in network storage
                   draft-ohlman-decade-add-use-cases-reqs-02

Abstract

   The DECoupled Application Data Enroute (DECADE) working group is
   specifying standardized interfaces for accessing in-network storage
   from applications to store, retrieve and manage data. The main
   objective is to provide a framework that is useful to P2P
   applications, without excluding other, possibly related applications
   that can benefit from accessing in-network storage. This memo
   presents Internet TV as a specific application scenario where access
   to in-netork storage would be required and lists a set of concrete
   requirements that should be considered for the DECADE architecture
   and protocol specifications.

Requirements Language

   The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT",
   "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this
   document are to be interpreted as described in [RFC2119].

   Internet-Drafts are draft documents valid for a maximum of six months
   and may be updated, replaced, or obsoleted by other documents at any
   time. It is inappropriate to use Internet-Drafts as reference
   material or to cite them other than as "work in progress."

   This Internet-Draft will expire on April 28, 2011.

Copyright Notice

Table of Contents

1. Introduction

   The DECADE approach to access to in-network storage through
   standardized interfaces has been motivated by P2P application
   scenarios where it can be beneficial to refer peers to in-network
   storage system in a convenient network-topological location in order
   to enhance data exchange for a given P2P application.

   One specific example would be a P2P application instance in a home
   network connected via an ADSL access network. In a traditional P2P
   approach, this application instance would download chunks from other
   peers and serve chunks to other peers in parallel. With an
   asymmetric uplink, the application instance (and other hosts on the
   home network) are likely to experience uplink congestion, if the
   application instance is selected by a substantial number of peers and
   has to serve data to them. In situations with prevalent asymmetric
   access links, the P2P session (all peer application instances) would
   also be limited in the achievable downlink speed because the
   aggregate uplink bandwidth is not sufficient.

   DECADE in-network storage servers are expected to be helpful in such
   scenarios, because peers could be referred to appropriate storage
   servers for downloading some content, thereby offloading traffic from
   the capacity-limited access uplinks.

   Such storage servers are expected to provide interfaces for storing,
   retrieving, and managing data. The general concept is that, in a
   distributed P2P application, some instance would upload data to a
   storage server and then refer other instances, such as P2P peers, to
   that data, for instance by passing a certain URI. In addition, there
   could be interactions for allocating capacity on servers for certain
   applications, for deleting data etc.

   This document argues that, while such a system would be very useful
   for P2P applications, there are others, related applications that
   could benefit from in-network storage in just the same way. Though
   only applications that does not lead to a completely new set of
   requirements should be taken into account. This document argues that
   it should be possible to extend the DECADE work to include certain
   other applications without increasing the overall complexity of the
   solution.

   Specifically, this document describes the in-network-storage aspects
   of Internet TV -- an important application today, that can
   significantly benefit from in-network-caching. We argue that it
   seems negligent to exclude Internet TV from leveraging DECADE in-
   network-storage and describe specific use cases for accessing in-
   network-storage in such a scenario. Moreover, we present a set of

requirements that should be met by the DECADE architecture design in
order guarantee its applicability to such applications. We propose
that these requirements be added to the DECADE requirements
specification.

In this memo, we align the requirement description to the layout used
in [I-D.gu-decade-reqs]. Section 2 describes the Internet TV
scenario, and Section 3 presents corresponding requirements that
should be considered to ensure a broad enough applicability of the
DECADE framework.

2. Internet TV Scenario

   Internet TV is a general term to refer to different kinds of systems
   or applications where video is delivered to (mostly) home network
   devices for immediate rendering or storing. In this memo, we refer
   to the distribution of video content, mainly focusing on Video-on-
   Demand (VoD) services and user-generated content.

   VoD services are commonly widespread in many service providers'
   networks. This scenario is characterized by the need to support an
   efficient large-scale distribution of video, possibly with a fairly
   high degree of replicated contents, to a multiplicity of fixed and
   mobile users. By supporting this application with DECADE protocols,
   video content can be retrieved from the in-network storage, achieving
   a number of benefits. The originating servers can be relieved from
   most of the load, since popular content will be automatically
   available in the in-network storage, closer to the users. Improved
   network efficiency will be achieved, reducing the traffic load in the
   upstream network segments. Moreover user experience, also for mobile
   users, can be improved.

2.1. Detailed Scenario Description

   A well-known issue with Internet TV applications such as YouTube is
   the flash crowd problem. That is also an example of a problem which
   could be significantly eased if in-network storage is used to provide
   users with locally available copies rather than all requesting the
   data from the source. This can be extra beneficial for services with
   real-time (or near real-time) components as traditional pre-caching
   solutions can be difficult to use then.

   A particular interesting Internet TV variant is "hybrid Internet TV"
   based on an Internet TV distribution service that is a hybrid between
   traditional CDN and a P2P service. Such a service would distribute
   content from central servers, make use of CDN caches on the way and
   finally use the end hosts/STB as caches for the P2P part of the

application.

If only the P2P application in the host/STB can store content in the
DECADE storage, the content first has to be downloaded from the
Internet TV server/CDN cache over the access link to the host/STB and
then uploaded, over the same access link, to the DECADE storage
before any peer in the P2P part of the application can access it from
the DECADE storage (instead of downloading it from the client).

To avoid this, it should be possible for the DECADE storage to
'cache' the content when the first download to the host/STB is done.
That would mean the content never have to travel over the capacity-
limited uplink. For this to be feasible, one requirement is that the
Internet TV service can prompt the DECADE storage that certain
content should be cached on its way to the host. Having such
functionality, that allows a host to get content from the DECADE
storage of neighboring host rather than from a central server, would
of course also offload the core network in the same way a traditional
CDN does.

2.2. Summary

The DECADE architecture and protocol specifications should take the
hybrid Internet TV scenario into account to ensure a reasonable level
of generality of the DECADE in-network storage. While P2P-specific
requirements should be considered, DECADE should not be unnecessarily
limited to it.

Specifically, dissemination applications of streaming type (some with
real-time or close to real-time requirements) should be supported by
DECADE as they can cause significant load on the network. The
network load could be reduced significantly for these types of
applications if copies stored locally in the network could be used
instead of always fetching data from the source.

3. Specific requirements

3.1. Unique Naming of Information Objects

3.1.1. Requirement

When a DECADE client in a certain application context stores an
information object in DECADE storage servers, the object MUST be
addressable by a unique name across different application contexts.

3.1.2. Rationale

   There is a need for unique naming to enable different application
   instances to refer to information objects using a name (that may have
   been provided to them by another DECADE client). Such unique naming
   is essential for efficient cache handling and can serve for de-
   duplication.

3.1.3. Discussion

   Unique naming can be achieved in different ways. Names can assigned
   from some (structured) names, for instance by URIs. Names can also
   be generated, for instance by calculating hashes of the object's
   content.

   The detailed syntax and semantics of DECADE names (and the actual
   standardization requirements) are for further study.

3.2. Access to Information Objects

3.2.1. Requirement

   It MUST be possible to access data stored on DECADE storage servers
   as complete information objects, such as a named video file.

3.2.2. Rationale

   In a video-on-demand caching use case, the client application should
   be enabled to retrieve the complete object in one transaction and
   should not be required to download individual chunks.

3.2.3. Discussion

   This does not necessarily impose implications on the way that the
   storage servers stores the object.

3.3. Real-time Support

3.3.1. Requirement

   The DECADE storage service MUST support real-time applications in a
   way that a resource that is being uploaded is already available for
   download.

3.3.2. Rationale

   For larger objects or chunks, it is not acceptable if a DECADE client
   has to upload the complete resource first, before other clients can

start downloading it.

3.3.3. Discussion

This requirement should also be important for P2P live streaming.

3.4. Discovery service for DECADE in-network storage

3.4.1. Requirement

When a DECADE client attach to a DECADE enabled network there SHOULD
be a discovery service that can tell a DECADE client where in-network
storage servers can be found.

3.4.2. Rationale

To minimize manual configuration of the DECADE clients, a discovery
service, similar to DHCP , should be provided in the DECADE enabled
network.

3.4.3. Discussion

In particular, this simplifies the administration of the DECADE in-
network storage for a user that roams to a visited network.

3.5. Multiple active DECADE Storage Servers

3.5.1. Requirement

A DECADE client SHOULD be able to use multiple in-network storage
servers at the same time.

3.5.2. Rationale

One example of when this is needed is when a user/client roams to
another network, then it is reasonable to assume that the currently
used in-network storage remains active for a certain time not to
disrupt ongoing communication sessions at the same time as another
in-network storage might immediately be needed in the new network.

3.5.3. Discussion

A user of DECADE in-network storage who roams to a visited network
could potentially cause very inefficient access to that user's DECADE
storage. It is therefore essential that the user is able to acquire
new DECADE storage which is better located in the visited network.
Usage that could result in such inefficiencies is communication with
other users locally in the same network, for example as part of a

small meeting or large event (fair, sports event, etc).

A related issue is the possibility to migrate content from one DECADE storage to another when roaming. We believe that this is covered by the requirements on Efficient Transfer (section 3.3) and Communication among In-network Storage Elements (section 4.3) of [I-D.gu-decade-reqs].

4. IANA Considerations

This document has no requests to IANA.

5. Security Considerations

The re-use of copies in the network part of DECADE will require that appropriate access control mechanisms are designed.

6. Acknowledgments

We would like to thank all persons participating in the Network of Information work package in the EU FP7 projects 4WARD and SAIL for contributions and feedback to this document.

7. Informative References

[I-D.gu-decade-reqs]
          Yingjie, G., Bryan, D., Yang, Y., and R. Alimi, "DECADE
          Requirements", draft-gu-decade-reqs-05 (work in progress),
          July 2010.

[RFC2119] Bradner, S., "Key words for use in RFCs to Indicate
          Requirement Levels", BCP 14, RFC 2119, March 1997.

Authors' Addresses

   Borje Ohlman
   Ericsson
   Stockholm
   Sweden

   Email: Borje.Ohlman@ericsson.com

Ove Strandberg
Nokia Siemens Networks
Linnoitustie 6
Espoo
Finland

Email: ove.strandberg@nsn.com

Christian Dannewitz
University of Paderborn
Paderborn
Germany

Email: cdannewitz@upb.de

Anders Lindgren
Swedish Institute of Computer Science
Stockholm
Sweden

Email: andersl@sics.se

Roberta Maglione
Telecom Italia
Turin
Italy

Email: roberta.maglione@telecomitalia.it

Bengt Ahlgren
Swedish Institute of Computer Science
Stockholm
Sweden

Email: bengta@sics.se

Dirk Kutscher
NEC Laboratories Europe
Kurfuersten-Anlage 36
Heidelberg
Germany

Email: kutscher@neclab.eu