

## Description of Working Group

Peer-to-Peer (P2P) applications, including both P2P streaming and P2P file-sharing applications, make up a large fraction of traffic in the Internet today. One way to reduce access network and/or cross-domain bandwidth usage by P2P applications is to introduce storage capabilities in the network between hosts running P2P applications. Allowing P2P applications to store and retrieve data from inside the network can reduce traffic on the last-mile uplink, as well as backbone and transit links.

Existing P2P caches often implement the specific P2P application protocols to operate transparently or act as super peers to provide in-network storage. However, it is challenging for P2P cache vendors to support a variety of evolving protocols. Also, for P2P applications, closed P2P caching systems limit effective utilization of in-network storage. Some P2P protocols may be entirely unsupported by a particular caching system. Additionally, applications may be better-equipped to decide how in-network storage is used to meet their specific requirements (e.g., data placement, access control and resource control). Note that providers of in-network storage may impose their own access control or resource usage policies.

Both of these challenges can be effectively addressed by using open, standard protocols to access in-network storage. P2P applications can store and retrieve content in the in-network storage, as well as control resources (e.g., bandwidth, connections) consumed by peers in a P2P application. As a simple example, a peer can choose to store content in the in-network storage, and direct other peers to retrieve from that location, reducing last-mile link usage. Furthermore, since a P2P client may have multiple peers, it can control resources used by each peer to store and retrieve content. Though there are existing data access protocols (e.g., HTTP, NFS, WebDAV), they might be

lacking capabilities for fine-grained access and resource control (e.g., bandwidth and connections) that are essential for today's advanced P2P applications.

The Working Group (WG) has finished WGLC on the following three tasks, which documents are stabilized.

First, the WG identifies target applications to appropriately scope the problem and requirements. P2P and other content distribution applications, like file sharing, file downloading and video streaming are the primary targets, but suitability to other applications with similar requirements may be considered depending on additional complexity required to support such applications.

Second, the WG identifies the requirements to enable target applications to utilize in-network storage. Requirements included the ability for an application to (1) store, retrieve, and manage data, (2) indicate access control policies for storing and retrieving data suitable to an environment with users across multiple administrative and security domains (e.g., in a P2P environment), and (3) indicate resource control policies for storing and retrieving data.

Third, the WG develops an architecture within which the DECADE protocol can be specified. This architecture identifies DECADE's relationship to existing IETF protocols and where (if any) new protocol(s) may be needed or extensions to existing protocols need to be made.

The WG has the following tasks for the next step.

Fourth, the WG will specify a standard resource control protocol between applications and in-network storage, and between in-network storage systems. The resource control protocol will define access control, resource sharing, and

content replication parameters for content delivery that will be implemented by the in-network storage. The resource control protocol will be based on existing IETF protocols that have seen wide deployment. Existing data transport protocols will be reused to store/retrieve/delete/replicate objects. The WG will identify a possibly minimum extension for carrying resource control parameters with these data transport protocols. One mandatory data transport protocol will be specified to improve interoperability. A minimum set of data and storage control attributes will be defined.

Fifth, a discovery mechanism for user to locate the serving in-network storage node is required.

One mandatory naming scheme is required for interoperability. Certain content de-duplication and security properties may be improved depending on the chosen naming scheme. A uniform naming scheme will be developed in this WG but the basic scheme will also be applicable to Websec and other WGs that have similar requirements.

The WG will focus on the following work items:

- A "problem statement" document. This document provides a description of the problem and common terminology.
- A requirements document. This document lists the requirements for the in-network storage service (e.g., supported operations) and the protocol to support it. The service will include storing, retrieving, and managing data as well as specifying both access control and resource control policies in the in-network storage pertaining to that data.

- (finished) A survey document. This document will survey existing related mechanisms and protocols (e.g., HTTP, NFS, and WebDAV), and evaluate their applicability to DECADE.
- An architecture document. This document will identify DECADE's relationship with existing IETF protocols. Existing protocols will be used wherever possible and appropriate to support DECADE's requirements. In particular, data storage, retrieval, and management may be provided by an existing IETF protocols. The WG will not limit itself to a single data transport protocol since different protocols may have varying implementation costs and performance tradeoffs. However, to keep interoperability manageable, a small number of specific, targeted, data transport protocols will be identified and used.
- A protocol document. This document will specify the language between applications and in-network storage, and between in-network storage systems. This protocol will specify mechanisms for the accessing control and network resource control related to the particular content distribution, and a mandatory data transport protocol will be identified.
- A discovery document. This document will specify the ways for applications to locate in-network storage node(s) to serve it.
- A naming scheme document. The scheme may be useful in other WGs with similar requirements.
- A document describing the integration of DECADE with existing content distribution applications (e.g., integration with BitTorrent).

The following issues are considered out-of-scope for the WG:

- Specification of policies regarding copyright-protected or illegal content.
- Locating the "best" in-network storage location from which to retrieve content if there are more than one location can provide the same content. This is assumed to be provided by ALTO.
- Developing a new protocol for data transport between P2P applications and in-network storage.

#### Goals and Milestones

- Done Working Group Last Call for Problem Statement
- Done Submit Problem Statement to IESG as Informational
- Done Working Group Last Call for Survey document
- Done Submit Survey document to IESG as Informational
- Done Working Group Last Call for Requirements document
- Done Working Group Last Call for Architecture document
- Nov 2011 Submit Requirements document to IESG as Informational
- Nov 2011 Submit Architecture document to IESG as Informational
- Mar 2011 Working Group Last Call for DECADE Integration Examples
- Apr 2012 Submit DECADE Integration Examples to IESG as Informational
- Nov 2012 Working Group Last Call for the DECADE Discovery
- Nov 2012 Working Group Last Call for DECADE protocol
- Nov 2012 Working Group Last Call for the naming scheme
- Mar 2013 Submit DECADE Discovery to IESG as Informational
- Mar 2013 Submit DECADE Protocol to IESG as Proposed Standard
- Mar 2013 Submit the naming scheme to IESG as Proposed Standard