**Services provided by IETF transport protocols and congestion control
                              mechanisms
                 draft-ietf-taps-transports-00**

Abstract

   This document describes services provided by existing IETF protocols
   and congestion control mechanisms. It is designed to help
   application and network stack programmers and to inform the work of
   the IETF TAPS Working Group.

Status of This Memo

Copyright Notice

1. Introduction

Most Internet applications make use of the Transport Services
provided by TCP (a reliable, in-order stream protocol) or UDP (an
unreliable datagram protocol). We use the term "Transport Service"
to mean an end-to-end facility provided by the transport layer. That
service can only be provided correctly if information is supplied
from the application. The application may determine the information
to be supplied at design time, compile time, or run time and may
include guidance on whether an aspect of the service is required, a
preference by the application, or something in between. Examples of
Transport service facilities are reliable delivery, ordered delivery,
content privacy to in-path devices, integrity protection, and minimal
latency.

Transport protocols such as SCTP, DCCP, MPTCP, UDP and UDP-Lite have
been defined at the transport layer.

In addition, a transport service may be built on top of these
transport protocols, using a fraemwork such as WebSockets, or RTP.
Service built on top of UDP or UDP-Lite typically also need to
specify a congestion control mechanism, such as TFRC or the LEDBAT
congestion control mechanism. This extends the set of available
Transport Services beyond those provided to applications by TCP and
UDP.

Transport services can aslo be differentiated by the services they
provide: for instance, SCTP offers a message-based service that does
not suffer head-of-line blocking when used with multiple stream,
because it can accept blocks of data out of order, UDP-Lite provides
partial integrity protection when used over link-layer services that
can support this, and LEDBAT can provide low-priority "scavenger"
communication.

2. Terminology

The following terms are defined throughout this document, and in
subsequent documents produced by TAPS describing the composition and
decomposition of transport services.

The terminology below is that as was presented at the TAPS WG meeting
in Honolulu. While the factoring of the terminology seems
uncontroversial, thre may be some entities which still require names
(e.g. information about the interface between the transport and lower

layers which could lead to the availablity or unavailibility of
certain transport protocol features)

Transport Service Feature: a specific feature a transport service
   provides to its clients end-to-end. Examples include
   confidentiality, reliable delivery, ordered delivery, message-
   versus-stream orientation, etc.

Transport Service: a set of transport service features, without an
   association to any given framing protocol, which provides a
   complete service to an application.

Transport Protocol: an implementation that provides one or more
   different transport services using a specific framing and header
   format on the wire.

Transport Protocol Component: an implementation of a transport
   service feature within a protocol

Transport Service Instance: an arrangement of transport protocols
   with a selected set of features and configuration parameters that
   implements a single transport service, e.g. a protocol stack (RTP
   over UDP)

Application: an entity that uses the transport layer for end-to-end
   delivery data across the network.

3. Transport Protocols

This section provides a list of known IETF transport protocol and
transport protocol frameworks.

3.1. Transport Control Protocol (TCP)

TCP [RFC0793] provides a bidirectional byte-oriented stream over a
connection- oriented protocol. The protocol and API use the byte-
stream model.

[EDITOR'S NOTE: Mirja Kuehlewind signed up as contributor for this
section.]

3.1.1. Multipath TCP (MPTCP)

3.2. Stream Control Transmission Protocol (SCTP)

SCTP [RFC4960] provides a bidirectional set of logical unicast
streams over one a connection-oriented protocol. The protocol and
API use messages, rather than a byte-stream. Each stream of messages

is independently managed, therefore retransmission does not hold back
data sent using other logical streams.

[EDITOR'S NOTE: Michael Tuexen and Karen Nielsen signed up as
contributors for these sections.]

[3.2.1](). Partial Reliability for SCTP (PR-SCTP)

PR-SCTP [[RFC3758]()] is a variant of SCTP that provides partial
reliability.

[3.3](). User Datagram Protocol (UDP)

The User Datagram Protocol (UDP) [[RFC0768]()] provides a unidirectional
minimal message-passing transport that has no inherent congestion
control mechanisms. The service may be multicast and/or unicast.

[EDITOR'S NOTE: Kevin Fall signed up as contributor for this
section.]

[3.3.1](). UDP-Lite

A special class of applications can derive benefit from having
partially-damaged payloads delivered, rather than discarded, when
using paths that include error-prone links. Such applications can
tolerate payload corruption and may choose to use the Lightweight
User Datagram Protocol [[RFC3828]()]. The service may be multicast and/
or unicast.

[3.4](). Datagram Congestion Control Protocol (DCCP)

The Datagram Congestion Control Protocol (DCCP) [[RFC4340]()] is a
bidirectional transport protocol that provides unicast connections of
congestion-controlled unreliable messages. DCCP is suitable for
applications that transfer fairly large amounts of data and that can
benefit from control over the tradeoff between timeliness and
reliability.

[3.5](). Realtime Transport Protocol (RTP)

RTP provides an end-to-end network transport service, suitable for
applications transmitting real-time data, such as audio, video or
data, over multicast or unicast network services, including TCP, UDP,
UDP-Lite, DCCP.

[EDITOR'S NOTE: Varun Singh signed up as contributor for this
section.]

3.6. Hypertext Transport Protocol (HTTP) as a pseudotransport

   [RFC3205]

3.6.1. WebSockets

   [RFC6455]

4. Transport Service Features

   Features as derived from the subsections above.

   This section is blank for now.

5. IANA Considerations

   This document has no considerations for IANA.

6. Security Considerations

   This document surveys existing transport protocols and protocols
   providing transport-like services. Confidentiality, integrity, and
   authenticity are among the features provided by those services. This
   document does not specify any new components or mechanisms for
   providing these features. Each RFC listed in this document discusses
   the security considerations of the specification it contains.

7. Contributors

   Non-editor contributors of text will be listed here, as in the
   authors section.

8. Acknowledgments

   This work is partially supported by the European Commission under
   grant agreement FP7-ICT-318627 mPlane; support does not imply
   endorsement. Special thanks to Mirja Kuehlewind for the terminology
   section and for leading the terminology discussion in Honolulu.

9. References

9.1. Normative References

   [RFC0791] Postel, J., "Internet Protocol", STD 5, RFC 791, September
              1981.

   [RFC2460] Deering, S. and R. Hinden, "Internet Protocol, Version 6
              (IPv6) Specification", RFC 2460, December 1998.

9.2. Informative References

   [RFC0768] Postel, J., "User Datagram Protocol", STD 6, RFC 768,
              August 1980.

   [RFC0793] Postel, J., "Transmission Control Protocol", STD 7, RFC
              793, September 1981.

   [RFC0896] Nagle, J., "Congestion control in IP/TCP internetworks",
              RFC 896, January 1984.

   [RFC1122] Braden, R., "Requirements for Internet Hosts -
              Communication Layers", STD 3, RFC 1122, October 1989.

   [RFC2018] Mathis, M., Mahdavi, J., Floyd, S., and A. Romanow, "TCP
              Selective Acknowledgment Options", RFC 2018, October 1996.

   [RFC3168] Ramakrishnan, K., Floyd, S., and D. Black, "The Addition
              of Explicit Congestion Notification (ECN) to IP", RFC
              3168, September 2001.

   [RFC3205] Moore, K., "On the use of HTTP as a Substrate", BCP 56,
              RFC 3205, February 2002.

   [RFC3390] Allman, M., Floyd, S., and C. Partridge, "Increasing TCP's
              Initial Window", RFC 3390, October 2002.

   [RFC3758] Stewart, R., Ramalho, M., Xie, Q., Tuexen, M., and P.
              Conrad, "Stream Control Transmission Protocol (SCTP)
              Partial Reliability Extension", RFC 3758, May 2004.

   [RFC3828] Larzon, L-A., Degermark, M., Pink, S., Jonsson, L-E., and
              G. Fairhurst, "The Lightweight User Datagram Protocol
              (UDP-Lite)", RFC 3828, July 2004.

   [RFC4340] Kohler, E., Handley, M., and S. Floyd, "Datagram
              Congestion Control Protocol (DCCP)", RFC 4340, March 2006.

   [RFC4960] Stewart, R., "Stream Control Transmission Protocol", RFC
              4960, September 2007.

   [RFC5348] Floyd, S., Handley, M., Padhye, J., and J. Widmer, "TCP
              Friendly Rate Control (TFRC): Protocol Specification", RFC
              5348, September 2008.

   [RFC5405] Eggert, L. and G. Fairhurst, "Unicast UDP Usage Guidelines
              for Application Designers", BCP 145, RFC 5405, November
              2008.

   [RFC5925] Touch, J., Mankin, A., and R. Bonica, "The TCP
              Authentication Option", RFC 5925, June 2010.

   [RFC5681] Allman, M., Paxson, V., and E. Blanton, "TCP Congestion
              Control", RFC 5681, September 2009.

   [RFC6093] Gont, F. and A. Yourtchenko, "On the Implementation of the
              TCP Urgent Mechanism", RFC 6093, January 2011.

   [RFC6298] Paxson, V., Allman, M., Chu, J., and M. Sargent,
              "Computing TCP's Retransmission Timer", RFC 6298, June
              2011.

   [RFC6455] Fette, I. and A. Melnikov, "The WebSocket Protocol", RFC
              6455, December 2011.

   [RFC6691] Borman, D., "TCP Options and Maximum Segment Size (MSS)",
              RFC 6691, July 2012.

   [RFC7323] Borman, D., Braden, B., Jacobson, V., and R.
              Scheffenegger, "TCP Extensions for High Performance", RFC
              7323, September 2014.

Authors' Addresses

   Godred Fairhurst (editor)
   University of Aberdeen
   School of Engineering, Fraser Noble Building
   Aberdeen AB24 3UE

   Email: gorry@erg.abdn.ac.uk

   Brian Trammell (editor)
   ETH Zurich
   Gloriastrasse 35
   8092 Zurich
   Switzerland

   Email: ietf@trammell.ch