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Services provided by IETF transport protocols and congestion control mechanisms
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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

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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

This section presents the terminology used in this document.

[EDITOR’S NOTE: Terminology to be discussed in Honolulu. We need to determine what a "service" as used by the IETF, as opposed to a "service component", "property", an "aspect", "dimension", etc.]

3. Transport Protocols

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

[EDITOR'S NOTE: combine these tables into one? Also, reorder them to match ths sections below.]

Section	Benefit	Setup	Mode
3.1	Transmission Control Protocol (TCP)	CO	Unicast
3.1.1	Multipath-TCP (MPTCP)	CO	Unicast
3.2	SCTP	CO	Unicast
3.2.1	SCTP-PR	CO	Unicast
3.3	User Datagram Protocol (UDP)	DG	Unicast/Multicst
3.4	UDP-Lite	DG	Unicast/Multicst
3.5	DCCP	CO	Unicast
3.X	More as needed		

Table 1: Key IETF Transport Protocol - by cmmunication mode

Section	Benefit	Style	Reliability
3.1	Transmission Control Protocol (TCP)	Str	Ordered Byte Stream
3.1.1	Multipath-TCP (MPTCP)	Str	Ordered Byte Stream
3.2	SCTP	Mess	Message Streams
3.2.1	SCTP-PR	Mess	Partial M Streams
3.3	User Datagram Protocol (UDP)	Mess	Datagram Message
3.4	UDP-Lite	Mess	Error Tolerant DG
3.5	DCCP	Mess	Unrel Message Stream
3.X	More as needed		

Table 2: Key IETF Transport Protocol - by reliability

"Setup" defines whether the protocol performs a connection-oriented protocol handshake prior o communication or is datagram based. This provides reliable negotiation of options, including negotiation of a suitable congestion control mechanism.This property can impact the ability of the protocol to traverse firewalls.

Section	Benefit	Congestion Control
3.1	Transmission Control Protocol (TCP)	Yes
3.1.1	Multipath-TCP (MPTCP)	Yes (Multipath)
3.2	SCTP	Yes
3.2.1	SCTP-PR	Yes
3.3	User Datagram Protocol (UDP)	At application layer
3.4	UDP-Lite	At application layer
3.5	DCCP	Yes, Various CCIDs defined
3.X	More as needed	

Table 3: Key IETF Transport Protocol - by congestion control

Some other protocol frameworks that may potentially be considered for inclusion in future versions of this document. Examples are:

- Multicast - RMT
- RTP-based methods
- HTTP-based methods
- TLS
- DTLS

The following subsections describes each of these transports.

3.1. Transport Control Protocol (TCP)

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

[EDITOR'S NOTE: Describe the aspects(?) of TCP: reliable, connection-oriented, congestion-controlled, single-stream-oriented, non-boundary-preserving... Note that we want to describe the characteristics of the SOCK_STREAM API as well as just the wire protocol.]

3.1.1. Multipath TCP (MPTCP)

[EDITOR'S NOTE: aspects of MPTCP beyond TCP.]

3.2. Stream Control Transmission Protocol (SCTP)

This section will describe SCTP.

SCTP 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

3.2.1. Partial Reliability SCTP (PR-CTP)

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

3.3. User Datagram Protocol (UDP)

The User Datagram Protocol (UDP) 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: Describe the aspects(?) of UDP: unreliable, congestion control to be applied above the transport, datagram-oriented, connectionless, boundary-preserving... Note that we want to describe the characteristics of the SOCK_DGRAM API as well as just the wire protocol.]

Using UDP robustly requires each application to implement a raft of functions (mostly re-inventing or adaptng mechansism already found in TCP, SCTP and DCCP). [EDITOR'S NOTE: reference RFC 5405/bis]

3.4. 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 (UDP-Lite) The service may be multicast and/or unicast

[EDITOR'S NOTE: compare to UDP]

[RFC3828] and [RFC 5405/bis]

3.5. Datagram Congestion Control Protocl (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.

[EDITOR'S NOTE: Describe the aspects(?) of DCCP...]

[FC4340 et al]

3.6. 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: Describe the aspects(?) of RTP...]

3.7. Hypertext Transport Protocol (HTTP) as a pseudotransport

HTTP provides end-to-end network unicast transport service.

[EDITOR'S NOTE: Reference BCP 56, note that this implies TCP but also brings with it object semantics you may not want.]

3.7.1. WebSockets

[EDITOR'S NOTE: point out how websockets kind of fixes this.]

4. Transport service components

Aspects as derived from the subsections above.

This section is blank for now.

5. Acknowledgements

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Comments are welcome to the authors or via the IETF TAPS mailing lists.

6. IANA Considerations

XXX RFC ED - PLEASE REMOVE THIS SECTION XXX

This memo includes no request to IANA.

7. Security Considerations

This document introduces no new security considerations. Each RFC listed in this document discusses the security considerations of the specification it contains.

8. References

8.1. Normative References

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8.2. Informative References

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

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