              **Congestion control for the Saratoga protocol**
              **draft-wood-tsvwg-saratoga-congestion-control-11**

Abstract

   Saratoga is a data transfer protocol designed to carry potentially
   large volumes of data over difficult network paths, often including
   only a single high-rate link and only one application flow.  As the
   requirements for use vary across deployment environments, the base
   Saratoga specification only assumes that an implementation will be
   able to clock packets out at a configurable rate, and beyond this
   specifies no inherent or particular congestion-control behaviour.
   The design of Saratoga deliberately supports the integration of
   congestion-control algorithms without modification to the base
   protocol.  This document describes how congestion control can be
   supported in the Saratoga transfer protocol.  Saratoga is intended
   for use in private networks, where its use is engineered as a single
   flow to fill a link.  However, as Saratoga is implemented over UDP,
   it can be multiplexed, and can be run across the public Internet, in
   which case congestion control in accordance with the UDP Guidelines
   becomes necessary.

Status of This Memo

   This Internet-Draft is submitted to IETF in full conformance with the
   provisions of BCP 78 and BCP 79.

   Internet-Drafts are working documents of the Internet Engineering
   Task Force (IETF).  Note that other groups may also distribute
   working documents as Internet-Drafts.  The list of current Internet-
   Drafts is at http://datatracker.ietf.org/drafts/current/.

   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 November 24, 2017.

Copyright Notice

Table of Contents

## 1.  Background and Introduction

   The Saratoga data transfer protocol is described in
   [draft-wood-tsvwg-saratoga].  Given that Saratoga was originally
   developed for scheduled peer-to-peer communications over dedicated
   links in private networks, where each application has the entire link
   for the duration of its transfer, many Saratoga implementations
   deliberately lack any form of congestion control and send at line
   rate to maximise throughput and link utilisation in their
   environments.  Congestion control is necessary for use in the public
   Internet, in accordance with the UDP Guidelines [RFC5405].  Newer
   Saratoga implementations may use timestamps to perform TCP-Friendly
   Rate Control (TFRC) [RFC5348] or other congestion control mechanisms
   such as LEDBAT [RFC6817], if appropriate for the environment, and
   where simultaneous sharing of capacity with other traffic and
   applications is required.  Sender-side TFRC for Saratoga has been
   shown to be possible without modifications to the Saratoga protocol

specification, using existing timestamps on selective negative
acknowledgement messages [draft-eddy-tsvwg-saratoga-tfrc].

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 RFC 2119.  [RFC2119]

## 2.  Approaches to congestion control

Saratoga can be implemented to perform congestion control at the
sender, based on feedback from acknowledgement STATUS packets, or
have the sender configured to use simple open-loop rate control to
only use a fixed amount of link capacity.  Congestion control is
expected to be undesirable for many of Saratoga's use cases and
expected environmental conditions, while simple rate control is
considered useful for some use cases.  Use over the public Internet
requires congestion control.

Congestion control MUST be supported and used if Saratoga is being
used across paths that go over the public Internet, and SHOULD be
supported in environments where links in the path are shared by
traffic flows.  Congestion control MAY NOT be supported across
private, single-flow links engineered for performance: Saratoga's
primary use case.

## 2.1.  TCP-friendly rate control

Sender-side TCP-friendly rate control can be implemented by mirroring
timestamps in STATUS messages and using the approach outlined in
[draft-eddy-tsvwg-saratoga-tfrc].

Other approaches to TCP-friendly congestion control are possible, and
Saratoga and its selective negative acknowledgements may prove useful
as an implementation testbed for developing and refining new
congestion-control algorithms.

## 2.2.  Explicit Congestion Notification

Supporting Explicit Congestion Notification in a UDP-based protocol
such as Saratoga requires that ECN events be exposed to userspace
applications using UDP via a programming interface.  Once such a
programming interface becomes available, providing counts of ECN
events in STATUS and DATA packets will be straightforward.  Until
that time, specifying ECN support in more detail is not required.

## 3.  Security Considerations

   Use of effective congestion control mechanisms always raises concerns
   about fairness and spoofing or misleading senders - issues not unique
   to Saratoga.

## 4.  IANA Considerations

   There should be no additional IANA considerations.

## 5.  Acknowledgements

   We thank the IETF for reminding us about the importance of congestion
   for standards-track protocols.

   Work on this document at NASA's Glenn Research Center was funded by
   NASA's Earth Science Technology Office (ESTO).

## 6.  References

### 6.1.  Normative References

   [RFC2119]  Bradner, S., "Key words for use in RFCs to Indicate
              Requirement Levels", BCP 14, RFC 2119,
              DOI 10.17487/RFC2119, March 1997,
              <http://www.rfc-editor.org/info/rfc2119>.

### 6.2.  Informative References

   [draft-eddy-tsvwg-saratoga-tfrc]
              Eddy, W., Wood, L., and W. Ivancic, "TFRC-based congestion
              control for Saratoga", draft-eddy-tsvwg-saratoga-tfrc-11
              (work in progress) , May 2017.

   [draft-wood-tsvwg-saratoga]
              Wood, L., Eddy, W., Smith, C., Ivancic, W., and C.
              Jackson, "Saratoga: A Scalable Data Transfer Protocol",
              draft-wood-tsvwg-saratoga-21 (work in progress) , May
              2017.

   [RFC5348]  Floyd, S., Handley, M., Padhye, J., and J. Widmer, "TCP
              Friendly Rate Control (TFRC): Protocol Specification",
              RFC 5348, DOI 10.17487/RFC5348, September 2008,
              <http://www.rfc-editor.org/info/rfc5348>.

   [RFC5405]   Eggert, L. and G. Fairhurst, "Unicast UDP Usage Guidelines
               for Application Designers", RFC 5405,
               DOI 10.17487/RFC5405, November 2008,
               <http://www.rfc-editor.org/info/rfc5405>.

   [RFC6817]   Shalunov, S., Hazel, G., Iyengar, J., and M. Kuehlewind,
               "Low Extra Delay Background Transport (LEDBAT)", RFC 6817,
               DOI 10.17487/RFC6817, December 2012,
               <http://www.rfc-editor.org/info/rfc6817>.

Authors' Addresses

   Lloyd Wood
   University of Surrey alumni
   Sydney, New South Wales
   Australia

   Email: L.Wood@society.surrey.ac.uk


   Wesley M. Eddy
   MTI Systems
   MS 500-ASRC
   NASA Glenn Research Center
   21000 Brookpark Road
   Cleveland, OH  44135
   USA

   Phone: +1-216-433-6682
   Email: wes@mti-systems.com


   Will Ivancic
   Syzygy Engineering LLC
   Westlake, OH  44145
   USA

   Phone: +1-440-835-8448
   Email: ivancic@syzygyengineering.com