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C. Hedrick  
Rutgers University  
D. Borman  
Cray Research, Inc.  
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## Telnet Remote Flow Control Option

### Status of This Memo

This RFC specifies an IAB standards track protocol for the Internet community, and requests discussion and suggestions for improvements. Please refer to the current edition of the "IAB Official Protocol Standards" for the standardization state and status of this protocol. Distribution of this memo is unlimited.

### Introduction

This document specifies an extended version of the Telnet Remote Flow Control Option, RFC 1080, with the addition of the RESTART-ANY and RESTART-XON suboptions.

#### 1. Command Names and Codes

TOGGLE-FLOW-CONTROL	33
OFF	0
ON	1
RESTART-ANY	2
RESTART-XON	3

#### 2. Command Meanings

##### IAC WILL TOGGLE-FLOW-CONTROL

Sender is willing to enable and disable flow control upon command.

##### IAC WONT TOGGLE-FLOW-CONTROL

Sender refuses to enable and disable flow control. Nothing is implied about whether sender does or does not use flow control. It is simply unwilling to enable and disable it using this protocol.

##### IAC DO TOGGLE-FLOW-CONTROL

Sender is willing to send commands to enable and disable flow control.

#### IAC DONT TOGGLE-FLOW-CONTROL

Sender refuses to send command to enable and disable flow control.

#### IAC SB TOGGLE-FLOW-CONTROL OFF IAC SE

Sender requests receiver to disable flow control.

#### IAC SB TOGGLE-FLOW-CONTROL ON IAC SE

Sender requests receiver to enable flow control.

#### IAC SB TOGGLE-FLOW-CONTROL RESTART-ANY IAC SE

Sender requests that when flow control is enabled, the receiver allow any character (except another XOFF) to restart output.

#### IAC SB TOGGLE-FLOW-CONTROL RESTART-XON IAC SE

Sender requests that when flow control is enabled, the receiver allows only the XON character to restart output.

### 3. Default Specification

The default specification for this option is

WONT TOGGLE-FLOW-CONTROL DONT TOGGLE-FLOW-CONTROL

meaning flow control information will not be exchanged in either direction.

### 4. Motivation

This memo describes a method of remotely toggling flow control between a user telnet process and the attached terminal. Only flow control of data being transmitted from the telnet process to the terminal is considered. Many systems will also allow flow control of data from the terminal to the telnet process, however there is seldom need to change this behavior repeatedly during the session.

There are two common ways of doing flow control: hardware and software. Hardware flow control uses signals on wires dedicated for this purpose. Software flow control uses one or two specific characters sent along the same path as normal input data. Most commonly, XOFF (control-S) and XON (control-Q) are used to stop and start output, respectively. The option described herein is useful primarily where software flow control is being used. (Since hardware flow control does not preempt any characters, there is normally no

need to disable it.) It should also be noted that flow control can either be generated automatically by the terminal when its buffers are close to overflowing, or manually by the user, when he/she cannot read the information as fast as it is being displayed, and unread information will start scrolling off the screen.

The primary difficulty with software flow control is that it preempts one or two characters. Host software often requires the user to be able to input every possible ASCII character. (Certain editors are notorious for having XOFF and XON as commonly-used commands.) For this reason, operating systems often allow programs to disable flow control. While it is disabled, the characters that normally signal flow control may be read as normal input. In a telnet environment, flow control is normally done by the user telnet process, not by the host computer. In addition, many operating systems, when flow control is enabled, the user may specify whether the XOFF character is the only character that is allowed to re-enable the output of data, or whether any typed character should re-enable the flow of data. Thus this RFC defines a way to propagate flow control status from the host computer to the user telnet process.

## 5. Description of the Option

Use of the option requires two phases. In the first phase, the telnet processes agree that one of them will TOGGLE-FLOW-CONTROL. WILL and DO are used only in this first phase. In general there will be only one exchange of WILL and DO for a session. Subnegotiations must not be issued until DO and WILL have been exchanged. It is permissible for either side to turn off the option by sending a WONT or DONT. Should this happen, no more subnegotiations may be sent, unless the option is re-enabled by another exchange of DO and WILL.

Once the hosts have exchanged a WILL and a DO, the sender of the DO TOGGLE-FLOW-CONTROL is free to send subnegotiations to enable and disable flow control in the other process, and to send subnegotiations for recommendations on when to restart output. Normally, the sender of the DO will be a host, and the other end will be a user telnet process, which is connected to a terminal. Thus the protocol is normally asymmetric, however it may be used in both directions without confusion should need for this arise.

As soon as the DO and WILL have been exchanged, the sender of the WILL must enable flow control. This allows flow control to begin in a known state. The decision of whether to restart output only when the XON character is received, or when any character received, starts in a system dependent state. (This is to make it consistent with older implementations of the TOGGLE-FLOW-CONTROL option that do not understand the RESTART-ANY and RESTART-XON suboptions.) The sender

of the DO should send either a RESTART-ANY or RESTART-XON suboption to put the restart characteristics to a known state. Some clients might not be able to support both of the RESTART-ANY and RESTART-XON modes due to system limitations, and would then choose to ignore these commands. There is no way for the server to be notified of this condition, but a client should make every attempt to honor the state requested by the RESTART-ANY and RESTART-XON modes. Should the option be disabled by exchange of DONT and WONT, flow control may revert to an implementation-defined default state. It is not safe to assume that flow control will remain in the state requested by the most recent subnegotiation.

In most implementations of software flow control, when enabled, the XOFF and XON characters are never propagated to the server; they are typically eaten by the terminal driver between the telnet client and the attached terminal. In most implementations that support the RESTART-ANY functionality, the typed character that re-enables the output is not eaten by the terminal driver, unless it is the XON character.

Currently, only four command codes are defined for the subnegotiations: flow control off (code 0), flow control on (code 1), restart output on any character (code 2) and restart output only on XON (code 3). None of these codes requires any additional data, however it is possible that additional commands may be added. Thus subnegotiations having command codes other than those defined in this document should be silently ignored.

This option does not deal with the issue of allowing the DO side of the connection to inform the WILL side which characters should be used for XON and XOFF. That functionality is already supplied by the LINEMODE [1] option.

## 6. Example

Here is an example of the use of this option:

Client	Server
	IAC DO TOGGLE-FLOW-CONTROL
IAC WILL TOGGLE-FLOW-CONTROL	
[ The server is now free to send commands to change flow control. Note that the client must now have enabled flow control, but that whether it is restart on XON only or on any character is client specific. ]	
	IAC SB TOGGLE-FLOW-CONTROL RESTART-ANY IAC SE
[ The client should now switch to allowing output to restart when the user types any character, if the client is able to support that functionality. ]	
	IAC SB TOGGLE-FLOW-CONTROL OFF IAC SE IAC SB TOGGLE-FLOW-CONTROL ON IAC SE

## References

- [1] Internet Engineering Task Force, Telnet Working Group,  
D. Borman, Editor, "Telnet Linemode Option", RFC 1184,  
Cray Research, Inc., October 1990.

## Acknowledgments

The original specification for this option was written by Charles Hedrick, and published as RFC 1080. The RESTART-ANY and RESTART-XON suboptions were defined and added to this version of the document by David Borman.

## Security Considerations

Security issues are not discussed in this memo.

## Authors' Addresses

David Borman  
Cray Research, Inc.  
655F Lone Oak Drive  
Eagan, MN 55121

Phone: (612) 452-6650  
Email: dab@CRAY.COM

Charles Hedrick  
Director, LCSR Computing Facility  
Rutgers University  
227 CORE Building  
P.O. Box 879  
Piscataway, NJ 08855-0879

Phone: (908) 932-3088  
Email: hedrick@cs.rutgers.edu

Mailing List: telnet-ietf@CRAY.COM