

Telnet Com Port Control Option

Status of this Memo

This memo defines an Experimental Protocol for the Internet community. This memo does not specify an Internet standard of any kind. Discussion and suggestions for improvement are requested. Distribution of this memo is unlimited.

Introduction

This memo proposes a protocol to allow greater use of modems attached to a network for outbound dialing purposes.

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Discussion

The Telnet protocol defines an interactive, character-oriented communications session. It was originally designed to establish a session between a client and a remote login service running on a host [5].

Many new business functions require a person to connect to remote services to retrieve or deposit information. By in large, these remote services are accessed via an async dial up connection. This new class of functions include:

- dial up connections to the Internet
- connecting to bulletin boards
- connecting to internal and external databases
- sending and receiving faxes.

The general nature of this new class of function requires an interactive, character-oriented communications session via an async modem. This is typically known as outbound modem dialing.

To help defer the cost of installing and maintaining additional phone lines which may be used very little per person, many equipment manufacturers have added the ability to establish a Telnet session directly to the outbound ports on many of the most popular access servers and routers, here after referred to as access servers.

However, the current Telnet protocol definitions are not sufficient to fully support this new use. There are three new areas of functionality which need to be added to the Telnet protocol to successfully support the needs of outbound modem dialing. These are:

- The ability for the client to send com port configuration information to the access server which is connected to the outbound modem. This is needed to ensure the data being transmitted and received by the modem is formatted correctly at the byte level.
- The ability for the access server to inform the client of any modem line or signal changes such as RLSD changes (carrier detect). This information is vital, since many client software packages use this information to determine if a session with the remote service has been established. RLSD changes are also used for signaling in Class I faxing [6].
- The ability to manage flow control between the client and the access server which does not interfere with the flow control mechanisms used by the session between the client and the remote service. Unfortunately RFC 1372 "Telnet Remote Flow Control Option" [2] can not be used for this purpose because it relies on sending XON/XOFF style characters which maybe transmitted or received as a normal course of the client / remote service session.

Though this discussion has focused on outbound modem dialing as the primary use of this protocol, the protocol can also be used for any serial device attached to an access server. Such devices could be:

- serial printers
- plotters
- monitoring devices such as pipe line monitors or medical monitors
- general office equipment such as photo-copiers and cash registers

Definition of Terms

Access Server - Any network device which accepts Telnet sessions and passes the data received to a com port, and passes data received from the com port to the client via the Telnet session.

Baud Rate - For the purposes of this document, baud rate will mean the communications of data in bits per second.

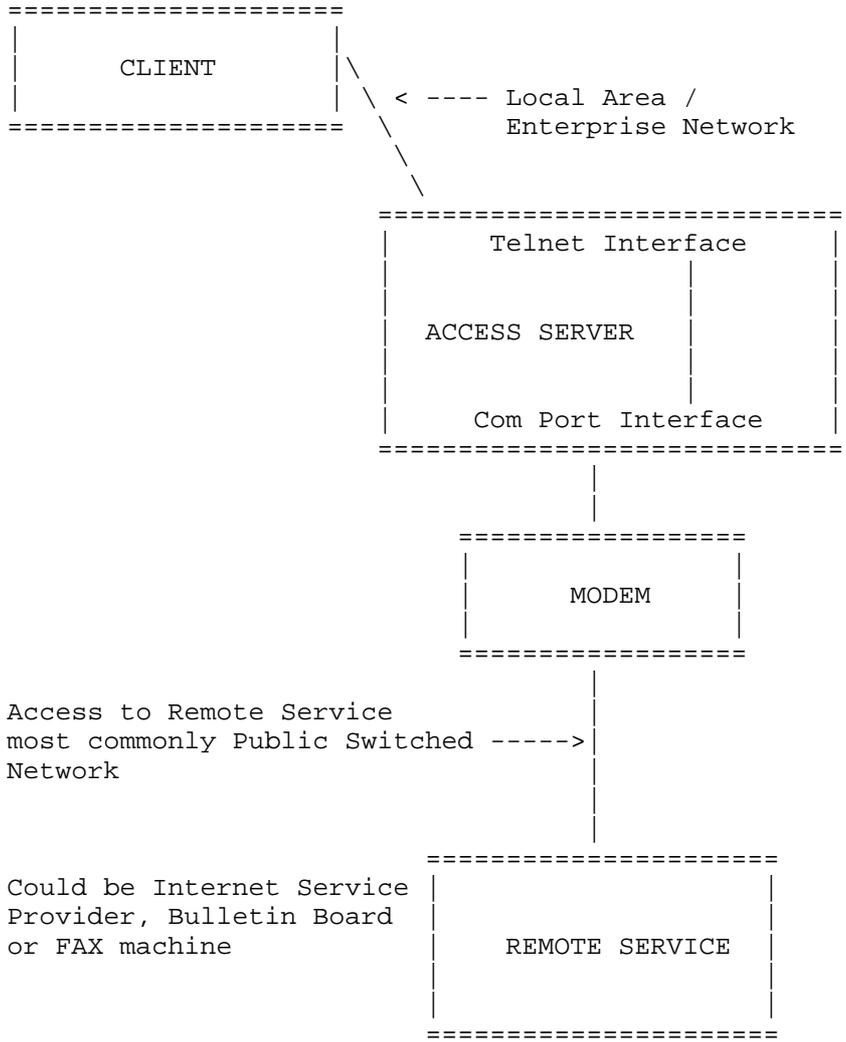
Client - Any network device which initiates a Telnet session to an access server.

Outbound - Transmission of data from the modem attached to the access server to a remote service.

Inbound - Transmission of data from the remote service to the modem attached to the access server.

Remove Service - Any service which accepts dial-up connections, including fax machines.

Illustration



Command Names and Codes:
COM-PORT-OPTION 44

	Client to Access Server	Access Server to Client
SIGNATURE	text	text
SET-BAUDRATE	1	101
SET-DATASIZE	2	102
SET-PARITY	3	103
SET-STOPSIZE	4	104
SET-CONTROL	5	105
NOTIFY-LINESTATE	6	106
NOTIFY-MODEMSTATE	7	107
FLOWCONTROL-SUSPEND	8	108
FLOWCONTROL-RESUME	9	109
SET-LINESTATE-MASK	10	110
SET-MODEMSTATE-MASK	11	111
PURGE-DATA	12	112

Discussion: As initially proposed, com port configuration commands are only sent from the client to the access server. There is no current vision that the access server would initiate the use of a com port configuration command, only the notify commands. However, to allow for access server initiated com port configurations different command values have been established.

1. Negotiation of the Com Port Control Option Protocol

The negotiation of the com port control option protocol uses the standard Telnet negotiation protocol mechanism:

IAC WILL COM-PORT-OPTION

The sender of this command is willing to send com port control option commands.

IAC WONT COM-PORT-OPTION

The sender of this command refuses to send com port control option commands.

IAC DO COM-PORT-OPTION

The sender of this command is willing to accept com port control option commands.

IAC DONT COM-PORT-OPTION

The sender of this command refuses to accept com port control options commands.

Typically a client will use WILL and WONT, while an access server will use DO and DONT.

2. Com Port Configuration Commands

Once DO and WILL have been negotiated, the client may send any of the following commands. The client can send these commands at any time and multiple times throughout the Telnet session. Each command transmitted from the client to the access server must be acknowledged once the command has been processed by the access server. This confirmation informs the client of the value set at the access server after the processing of the command. This acknowledgment is not used to acknowledge the receipt of the command, which is handled at the TCP protocol layer. Its purpose is to inform the client of the value in use, which may be different than the value requested in the client's command. For example, the client may request a baud rate higher than the access service can provide. If an acknowledgment is not received by the client within a reasonable time (such as twice the delay acknowledgment timer), the client may wish to resend the command or terminate the session.

Though the commands may be sent from the client to the access server in any sequence, there are sequences which may result in invalid configurations for the com port (for example: EVEN parity is only valid if the data size is set to less than 8 bits). Thus it is recommended that commands be issued in the following sequence:

1. SET-BAUDRATE
2. SET-DATASIZE
3. SET-PARITY
4. SET-STOPSIZE

IAC SB COM-PORT-OPTION SIGNATURE <text> IAC SE

This command may be sent by either the client or the access server to exchange signature information. If the command is sent without <text> it is a request from the sender to receive the signature text of the receiver. The text may be a combination of any characters. There is no structure to the <text> field. It may contain manufacturer information, version number information, or any other information desired. If an IAC character appears in the text it must be translated to IAC-IAC to avoid conflict with the IAC which terminates the command.

IAC SB COM-PORT-OPTION SET-BAUD <value(4)> IAC SE

This command is sent by the client to the access server to set the baud rate of the com port. The value is four octets (4 bytes). The value is represented in network standard format. The value is the baud rate being requested. A special case is the value 0. If the value is zero the client is requesting the current baud rate of the com port on the access server.

Discussion: Though baud rates used today form a very sparse space, and the initial version of the option used an index based baud rate table, after much discussion with a number of groups it has been determined that the actual baud rate should be used. There are two main reasons. 1) It limits the number of updates to the option as faster baud rates come into use, 2) It provides the greatest amount of flexibility in the selection of the baud rates.

IAC SB COM-PORT-OPTION SET-DATASIZE <value> IAC SE

This command is sent by the client to the access server to set the data bit size. The command can also be sent to query the current data bit size. The value is one octet (byte). The value is an index into the following value table:

Value	Data Bit Size
0	Request Current Data Bit Size
1	Available for Future Use
2	Available for Future Use
3	Available for Future Use
4	Available for Future Use
5	5
6	6
7	7
8	8
9-127	Available for Future Use

Discussion: There are only eight possible values for the data bit size, only four have ever been used historically and only two are commonly used today. The use of the command-value format is recommended to preserve consistency with other commands. It also reduces the number of commands defined in the protocol, and allows for future expansion.

IAC SB COM-PORT-OPTION SET-PARITY <value> IAC SE

This command is sent by the client to the access server to set the parity. The command can also be sent to query the current parity. The value is one octet (byte). The value is an index into the following value table:

Value	Parity [1]
0	Request Current Data Size
1	NONE
2	ODD
3	EVEN
4	MARK

5	SPACE
6-127	Available for Future Use

Discussion: There are only five possible values for parity commonly used today. The use of the command-value format is recommended to preserve consistency with other commands.

IAC SB COM-PORT-OPTION SET-STOPSIZE <value> IAC SE

This command is sent by the client to the access server to set the number of stop bits. The command can also be sent to query the current stop bit size. The value is one octet (byte). The value is an index into the following value table:

Value	Stop Bit Size
0	Request Current Data Size
1	1
2	2
3	1.5
4-127	Available for Future Use

Discussion: Stop bit 1.5 is supported by most com port hardware only if data size is set to 5 bits. It is not commonly used.

3. Special Com Port Control Commands

The client can send this command to the access server at any time and multiple times throughout the Telnet session. Each command transmitted from the client to the access server is acknowledged with a confirmation of the command and the actual value set. The client should expect a response within a reasonable time (such as twice the delay acknowledgment timer). The client may wish to resend any command which is not acknowledged or terminate the session.

IAC SB COM-PORT-OPTION SET-CONTROL <value> IAC SE

This command is sent by the client to the access server to set special com port options. The command can also be sent to query the current option value. The value is one octet (byte). The value is an index into the following value table:

Value	Control Commands
0	Request Com Port Flow Control Setting (outbound/both)
1	Use No Flow Control (outbound/both)
2	Use XON/XOFF Flow Control (outbound/both)
3	Use HARDWARE Flow Control (outbound/both)

4	Request BREAK State
5	Set BREAK State ON
6	Set BREAK State OFF
7	Request DTR Signal State
8	Set DTR Signal State ON
9	Set DTR Signal State OFF
10	Request RTS Signal State
11	Set RTS Signal State ON
12	Set RTS Signal State OFF
13	Request Com Port Flow Control Setting (inbound)
14	Use No Flow Control (inbound)
15	Use XON/XOFF Flow Control (inbound)
16	Use HARDWARE Flow Control (inbound)
17	Use DCD Flow Control (outbound/both)
18	Use DTR Flow Control (inbound)
19	Use DSR Flow Control (outbound/both)
20-127	Available for Future Use

Discussion: Flow control options were divided into inbound and outbound to take full advantage of existing programming interfaces and access server capabilities.

Discussion: The outbound values should set flow control for both outbound and inbound. If inbound is to be, or can be, set separately it should be done after the setting of the outbound value.

Discussion: If the access server is not able to set inbound flow control differently from the outbound flow control, it should ignore the inbound flow control commands and set the flow control option based on the outbound flow control commands only.

IAC SB COM-PORT-OPTION SET-LINESTATE-MASK <value> IAC SE

This command is sent by the client to the access server to set a bit mask for the sending of the NOTIFY-LINESTATE option (see section 4). When the LINESTATE changes on the access server, the access server will "AND" the new LINESTATE with the LINESTATE-MASK. If the result is not zero, the access server will send the result of the "AND" as the value in a NOTIFY-LINESTATE com port option. If more than one bit satisfies the LINESTATE-MASK, only one NOTIFY-LINESTATE, with all the satisfying bits, will be sent to the client. The SET-LINESTATE-MASK may be any combination of bits as listed below. These are the same bit values used in the NOTIFY-LINESTATE option. The SET-LINESTATE-MASK values are based on the most popular UART (com port control chip) in use [1].

Bit Position	Value	Meaning
7	128	Time-out Error
6	64	Transfer Shift Register Empty
5	32	Transfer Holding Register Empty
4	16	Break-detect Error
3	8	Framing Error
2	4	Parity Error
1	2	Overrun Error
0	1	Data Ready

Discussion: The SET-LINESTATE-MASK value of 0 will prevent the access server from sending NOTIFY-LINESTATE options to the client.

Discussion: The SET-LINESTATE-MASK value of 255 will allow the access server to send a NOTIFY-LINESTATE option to the client each time the LINESTATE changes on the access server.

Discussion: The initial LINESTATE-MASK at the access server is 0.

Discussion: The client does not have to send a new SET-LINESTATE-MASK after receiving a NOTIFY-LINESTATE. The LINESTATE-MASK on the access server is retained until set by the client or reset at the start of a new Telnet session.

IAC SB COM-PORT-OPTION SET-MODEMSTATE-MASK <value> IAC SE

This command is sent by the client to the access server to set a bit mask for the sending of the NOTIFY-MODEMSTATE option (see section 4). When the MODEMSTATE changes on the access server, the access server will "AND" the new MODEMSTATE with the MODEMSTATE-MASK. If the result is not zero, the access server will send the result of the "AND" as the value in a NOTIFY-MODEMSTATE com port option. If more than one bit satisfies the MODEMSTATE-MASK, only one NOTIFY-MODEMSTATE, with all the satisfying bits, will be sent to the client. The SET-MODEMSTATE-MASK may be any combination of bits as listed below. These are the same bit values used in the NOTIFY-MODEMSTATE option. The SET-MODEMSTATE-MASK values are based on the most popular UART (com port control chip) in use [1].

Bit Position	Value	Meaning
7	128	Receive Line Signal Detect (also known as Carrier Detect)
6	64	Ring Indicator
5	32	Data-Set-Ready Signal State
4	16	Clear-To-Send Signal State
3	8	Delta Receive Line Signal Detect
2	4	Trailing-edge Ring Detector
1	2	Delta Data-Set-Ready
0	1	Delta Clear-To-Send

Discussion: The SET-MODEMSTATE-MASK value of 0 will prevent the access server from sending NOTIFY-MODEMSTATE options to the client.

Discussion: The SET-MODEMSTATE-MASK value of 255 will allow the access server to send a NOTIFY-MODEMSTATE option to the client each time the MODEMSTATE changes on the access server.

Discussion: The initial MODEMSTATE-MASK at the access server is 255.

Discussion: The client does not have to send a new SET-MODEMSTATE-MASK after receiving a NOTIFY-MODEMSTATE. The MODEMSTATE-MASK on the access server is retained until set by the client or reset at the start of a new Telnet session.

IAC SB COM-PORT-OPTION PURGE-DATA <value> IAC SE

This command is sent by the client to the access server to instruct the access server to immediately clear all data from the buffer or buffers referenced by the value. The value is one octet (byte). The value is an index into the following value table:

Value	Purge Data Buffer
0	Available for Future Use
1	Purge access server receive data buffer
2	Purge access server transmit data buffer
3	Purge both the access server receive data buffer and the access server transmit data buffer
4-127	Available for Future Use

4. Notification of Com port and Modem Line Changes

The access server can send these commands to the client any time and multiple times throughout the Telnet session. The access server should send the appropriate command to the client as soon as the com port or modem line changes occurs. The client does not issue a response to these commands.

IAC SB COM-PORT-OPTION NOTIFY-LINESTATE <value> IAC SE

The value is one octet (byte). The value is a bit level composition made up from the value table below. Multiple bit values may be set in a single transmission. The values are based on the most popular UART (com port control chip) in use [1].

Bit Position	Value	Meaning
7	128	Time-out Error
6	64	Transfer Shift Register Empty
5	32	Transfer Holding Register Empty
4	16	Break-detect Error
3	8	Framing Error
2	4	Parity Error
1	2	Overrun Error
0	1	Data Ready

Discussion: The LINESTATE is the line state of the UART on the access server.

IAC SB COM-PORT-OPTION NOTIFY-MODEMSTATE <value> IAC SE

The value is one octet (byte). The value is a bit level composition made up from the value table below. Multiple bit values may be set in a single transmission. The values are based on the most popular UART (com port control chip) in use [1].

Bit Position	Value	Meaning
7	128	Receive Line Signal Detect (also known as Carrier Detect)
6	64	Ring Indicator
5	32	Data-Set-Ready Signal State
4	16	Clear-To-Send Signal State
3	8	Delta Receive Line Signal Detect
2	4	Trailing-edge Ring Detector
1	2	Delta Data-Set-Ready
0	1	Delta Clear-To-Send

5. Flow Control

The client and/or access server can send these commands any time and multiple times throughout the Telnet session.

```
IAC SB COM-PORT-OPTION FLOWCONTROL-SUSPEND IAC SE
  The sender of this command is requesting that the receiver
  suspend transmission of both data and commands until the
  FLOWCONTROL-RESUME is transmitted by the sender.
```

```
IAC SB COM-PORT-OPTION FLOWCONTROL-RESUME IAC SE
  The sender of this command is requesting that the receiver resume
  transmission of both data and commands.
```

Discussion: Established Telnet sessions are initially in a resume state between the client and the access server and the access server and the client. There is no need to send the resume command during session initialization.

Discussion: Multiple concurrent suspend commands may be sent. Secondary suspend commands can be ignored. Transmission will resume with the sending of a single resume command.

Discussion: The flow control option is designed to handle client to access server flow control for the Telnet session. This option has been added in deference to RFC 1372: Telnet Remote Flow Control Option [2]. RFC 1372 uses a simple character XON/XOFF technology to implement flow control. This can lead to two problems. First, the flow control characters may be valid data values. Second, the flow control characters may be used for end to end flow control (client application to remote dial up service).

6. Security Considerations

There are two security issues to discuss; authentication and resetting resources.

Authentication can follow either the Kerberos authentication protocol established in RFC 1411 [3] or the SPX authentication protocol established in RFC 1412 [4].

Once the Telnet session between the client and the access server has been terminated, the access server should ensure the connection to the remote service is disconnected and the com port geometry (baud

rate, data size, stop bits, parity, and flow control) is reset to a factory or administrator defined configuration. This ensures the com port is in a known state and ready to receive the next client session. This will make operations more predicable and avoid problems which might occur from starting a new session with random com port configurations.

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8. Reference Section

- [1] Joe Campbell. C Programmer's Guide to Serial Communications, Second Edition. Indianapolis: SAMS Publishing, 1993. 213-224.
- [2] Hedrick, C., and D. Borman, "Telnet Remote Flow Control Option", RFC 1372, Cray Research, Inc., October 1992.
- [3] Borman, D., "Telnet Authentication: Kerberos Version 4", RFC 1411, Cray Research, Inc., January 1993.
- [4] Alagappan, K., "Telnet Authentication: SPX", RFC 1412, Digital Equipment Corporation, January 1993.
- [5] D. E. Comer and David Stevens. Internetworking with TCP/IP, Volume III. Prentice Hall, 1993.
- [6] Andrew Margolis. The FAX Modem Sourcebook. John Wiley & Sons. 1995.

