INTERNET-DRAFT

Telnet Com Port Control Option
<draft-clark-telnet-control-04.txt>

Status Section:
  This document specifies an Internet standards track protocol for the
  Internet community, and requests discussion and suggestions for
  improvements. Please refer to the current edition of the
  "Internet Official Protocol Standards" (STD 1) for the
  standardization state and status of this protocol. Distribution of
  this memo is unlimited.

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

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
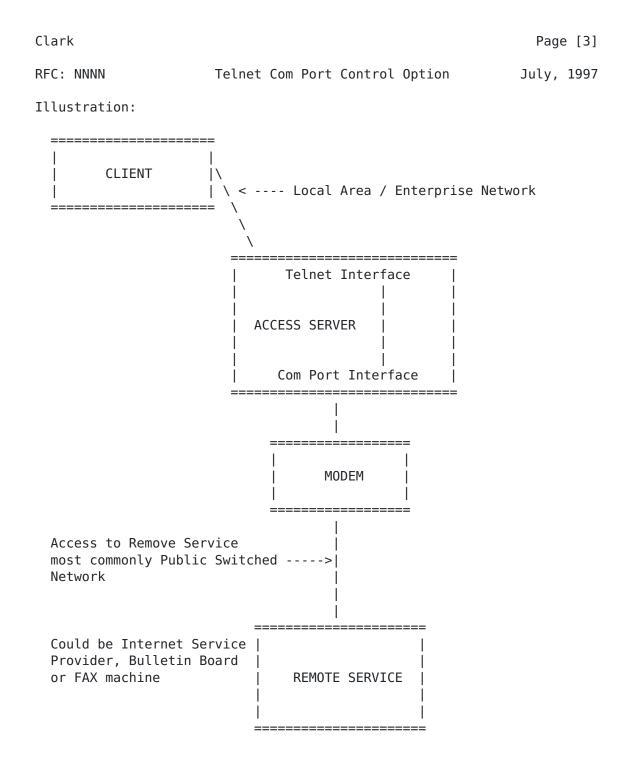async modem. This is typically known as outbound modem dialing.

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:

```
  ====================
  |                  |
  |      CLIENT      |\
  |                  | \ < ---- Local Area / Enterprise Network
  ====================  \
                         \
                          \
              ============================
              |      Telnet Interface     |
              |                   |       |
              |                   |       |
              |  ACCESS SERVER    |       |
              |                   |       |
              |                   |       |
              |      Com Port Interface   |
              ============================
                           |
                           |
                ==================
                |                |
                |     MODEM      |
                |                |
                ==================
                         |
  Access to Remove Service       |
  most commonly Public Switched ----->|
  Network                        |
                                 |
                                 |
                =======================
  Could be Internet Service |                   |
  Provider, Bulletin Board  |                   |
  or FAX machine            |   REMOTE SERVICE  |
                            |                   |
                            |                   |
                =======================
```

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    Command Names and Codes:
        COM-PORT-OPTION   40

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     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)

                  (Table continues on next page)
```

```
           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

   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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