Bolt Beranek and Newman Inc.

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June 1980

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The Terminal Access Controller (TAC) is a terminal controller for the ARPANET. The present document describes what the TAC does, what it does not do, and what its relationship is to the network.

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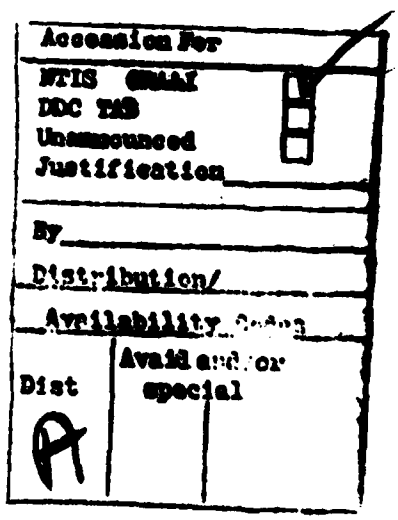

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1. Introduction

The purpose of this document is to specify the features of the Terminal Access Controller (TAC). It describes what the TAC does, what the TAC does not do, and what the TAC's relationship is to the network. It does this primarily by comparing the TAC to the H-316 TIP, working knowledge of which is assumed. This document does not attempt to describe the actual design of the TAC.

2. Basic Description of the TAC

The TAC is a terminal controller for the ARPANET. It supports two host-to-host protocols, the Transmission Control Protocol (TCP) and Internet Protocol, and the Network Control Protocol (NCP). In addition, it supports the Initial Connection Protocol (ICP) for NCP, old and new Telnet protocol, 1822 host-to-IMP protocol, and a command language. A user can connect to other hosts using either the TCP/Internet or NCP host-to-host protocols.

The TAC is based on the H-316 ARPANET TIP. It runs in a 32K H-316 machine with a 63 port Multi-Line Controller (MLC) and a host interface. It exists as a host connected to an IMP; it is a real host, as opposed to the H-316 TIP which runs in the same machine as an IMP. It is connected to an IMP via an 1822 hardware interface. The TAC can be either a local or distant host, but cannot run as a VDH host.

From the user's viewpoint the TAC is very similar to the H-316 TIP, since it supports most of the H-316 TIP's commands and features. In addition, it has several new features (such as TCP) that give it further capabilities.

3. New Features Supported

3.1 Transmission Control Protocol

The Transmission Control Protocol will be supported as it is specified in IEN 129, "DOD Standard Transmission Control Protocol", January 1980. The TAC will implement enough of the protocol to support the New Telnet virtual terminal protocol. Its implementation will be constrained by the existing structure of the H-316 TIP and memory limitations.

3.2 Internet Protocol

The Internet Protocol will be supported as specified in IEN 128, "DOD Standard Internet Protocol", January 1980. This document specifies version 4 of the protocol. The TAC will implement enough of the protocol to support TCP as specified in the previous section. This will include redirect messages from gateways.

3.3 New Telnet

The New Telnet virtual terminal protocol will be used for all TCP connections. It will be supported as described in "Telnet Protocol Specification" by J. Postel, May 1980. This is in most ways compatible with the New Telnet that the H-316 TIP currently supports for NCP.

3.4 Enhanced Hunting

A new hunting algorithm will be used in the TAC. It will be the same as the one used currently in the ARPANET Pluribus TIP. It will support hunting rates from 110 baud to 9600 baud and split rates. This new hunting algorithm is a marked improvement over the old H-316 TIP hunting. It hunts to a much wider range of rates and is easier to use from the user's point of view (there is only one hunting character instead of several).

3.5 Wild for TCP

The TAC will support wild ports for TCP. It will operate in a manner similar to the way the H-316 TIP does now for NCP. Particular ports can be set up to accept connections from other hosts. This may be from any net and/or host, or from a specific net and/or host.

3.6 Network Support

The TAC will have additional capabilities to allow it to be supported from the ARPANET. This includes Packet Core protocol, local and remote DDT, Trap reporting, status and measurement reporting, and a loader to allow loading of the TAC from the net. These features will work directly from the ARPANET and from Internet messages.

4. H-316 TIP Functions Not Supported

4.1 Old Telnet (Using TCP)

Old Telnet protocol will not be supported for TCP, because of its incompatibility with TCP and its lack of specification. It will continue to be supported for NCP.

4.2 Existing Low level Commands (for TCP)

The low level protocol commands in the H-316 TIP will not be supported for TCP since they are specific to NCP and not relevant to TCP. They will continue to be supported for NCP. As the TAC design is completed, new low level commands for TCP may be added.

4.3 RCTE

Remote Controlled Echoing will not be supported in the TAC. It is currently supported in the H-316 TIP. It does not work very well and is used by only one host in the ARPANET. Its

removal will help clean up the structure of the TAC and free more memory for new code and buffers.

4.4 IBM 2741

The IBM 2741 type terminal will not be supported in the TAC. There are several reasons for this. It requires a large amount of the H-316 TIP's resources (code and conversion tables) for support. In addition, it forces the TIP to use a limited type of hunting algorithm. The TAC will gain in several areas by not supporting IBM 2741s. There will be a significant savings in memory; the organization of the TAC will be much cleaner and better structured; it will be possible to use a new and more comprehensive hunting algorithm.

4.5 Mag Tape

The Magnetic Tape option will not be supported in the TAC. It exists at only one H-316 TIP site. Current plans call for its support to be discontinued.

4.6 Old Format Host Addressing

The old style format of addressing a host/IMP by a single number will not be supported. This format is a relic from old style short leaders. It allowed an obscure decimal equivalent of an eight bit field (two high order bits for Host, lower order 6 for IMP). For example, it permitted host 1 on IMP 3 to be

addressed as 67 and host 0 on IMP 5 to be addressed as 5. This was useful when there were four or fewer hosts per IMP and fewer than 64 IMPs. Now that there are more than 63 IMPs, and some IMPs have more than four hosts, it is confusing. For example, if a user wished to open a connection to host 0 on IMP 67, the tendency would be to use 67 as the address. As shown in the previous example this would result in a connection to host 1 on IMP 3. The only way to address host 0 on IMP 67 is by entering 0/67. Attempting to specify TCP Internet addresses would be even more confusing. For these reasons this type of addressing will not be supported in the TAC.

5. New commands

The TAC supports several new commands that allow a user to select the new features.

5.1 OPEN Command

The most important command is a new version of the OPEN command. The syntax of the OPEN command is as follows:

OPEN net: host/imp, socket

where net: is the number of the network to be connected to. The allowed range is 0 to 255. This parameter is optional. The default is the ARPANET. Any value other than the ARPANET is only valid when the port that entered the OPEN command is running in TCP mode.

The host/imp field specifies the address of the host that the user wishes to connect to. If the host/ field is not entered, host zero will be assumed. It may be a value from 0 to 255. The imp parameter must be specified. There is no default. It may be a value from 0 to 65,535. When the port is in TCP mode the host parameter is mapped into the upper 8 bits of the "local address" portion of the internet address. The imp parameter is mapped into the lower 16 bits of the internet "local address". This allows all internet address to be specified. When the port is in NCP mode the host and imp parameters are mapped into the correct portions of NCP leader.

The ,socket field specifies the socket that the TAC will first connect to. This parameter is optional. Its default value is the socket for New Telnet (23). If the port is running TCP it is the socket that the connection will be made to. If running NCP, it is the socket that ICP will use as a logger socket.

5.2 PROTOCOL Command

The PROTOCOL command is used to select which host-to-host protocol the TAC should use for the port that the command is entered on. Its syntax is as follows:

PROTOCOL TCP

or

PROTOCOL NCP

Depending on which version of the command is entered, the proper protocol will be used. The default protocol is TCP. This command is valid only when there is no open connection.

6. Commands Supported

The following is a list of the commands supported. Commands followed by an "*" are allowed only in NCP mode. Upper case words are commands. Underlined lower case words and "#" are arguments.

BINARY INPUT END
BINARY INPUT START
BINARY OUTPUT END
BINARY OUTPUT START
CLEAR DEVICE WILD
CLEAR INSERT LINEFEED
CLOSE
DEVICE CODE 37
DEVICE CODE ASCII
DEVICE CODE EXTRA-PADDING
DEVICE CODE OTHER-PADDING

DEVICE RATE #

ECHO HALFDUPLEX

ECHO LOCAL

ECHO REMOTE

FLOW CONTROL INPUT END

FLOW CONTROL INPUT START

FLOW CONTROL OUTPUT END

FLOW CONTROL OUTPUT START

FLUSH

GIVE BACK

HOST # *

INITIAL CONNECTION PROTOCOL *

INSERT LINEFEED

INTERCEPT #

INTERCEPT ESC

INTERCEPT NONE

NEW TELNET

OLD TELNET *

OPEN net: host/imp, socket

PROTOCOL BOTH *

PROTOCOL NCP

PROTOCOL TCP

PROTOCOL TO RECEIVE *

PROTOCOL TO TRANSMIT *

RECEIVE FROM HOST # *

RECEIVE FROM SOCKET # *

RECEIVE FROM WILD *

RESET

SEND ABORT OUTPUT

SEND ARE YOU THERE

SEND BREAK

SEND ERASE CHARACTER

SEND ERASE LINE

SEND INTERRUPT PROCESS

SEND SYNC

SEND TO HOST # *

SEND TO SOCKET # *

SEND TO WILD

SET DEVICE WILD

TRANSMIT EVERY #

TRANSMIT NOW

TRANSMIT ON LINEFEED

TRANSMIT ON MESSAGE END

7. Commands Not Supported

The following H-316 TIP commands will not be supported in the TAC.

CLEAR FLOW CONTROL

DIVERT OUTPUT

ECHO ALL

ECHO NONE

ECHO REMOTE CONTROLLED

FLOW CONTROL

LOGIN #

M # #

NETWORK-VIRTUAL-TIP-EXEC

SEND COMMAND

8. Summary

This document has specified the function of the Terminal Access Controller. The TAC runs as a stand-alone host in the ARPANET. It supports two host-to-host protocols, TCP and NCP, and has new capabilities that the H-316 TIP does not have (such as a new hunting algorithm). It eliminates some old features of the H-316 TIP that are not needed, which results in several improvements to the TAC.