CONTRA COSTA COUNTY
EMERGENCY MEDICAL SERVICES

AUTOMATED EMS MESSAGE
TRANSMISSION NETWORK SPECIFICATION

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This document is the authoritative description of the design guidelines and specifications for EMS Message Transmission Network (MTN).

Send any questions and proposed changes to the address shown above. Copies of this document in Word 2000 format are available from the EMS Agency.

Revision History

January 25, 1993 - Initial release

January 26, 1993 - ver 0.10

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Added Appendix G, MTN II, and moved Carbon Copies to it. Added a proposed change of Type 04 messages from uni-directional to bi-directional and a suggestion for handling new Thomas Bros. map references to Appendix G. Removed the agency mnemonic prefix from the *unit-id* field definition. Removed Type 81 message in favor of the emerging TCP/IP `timeserver` and `timed` facilities, or a portable time client daemon (source code available at EMS). Changed Unit Name terminology to Unit ID in the glossary. Removed references to the :SYSMGR BBS and changed the location of the MTN Common Data Repository from host MSGA to host EMS. Converted to WordPerfect for Windows 6.1 format. Added agency codes MOR, MSC, and SOT. Added TST incident type with usage remark in Type 01 message description. Added equipment codes for Paramedic, Supervisor and ALS First Responder. Moved the MTN Incident Identifier section ahead of its first reference. Expanded the MTN Standard Time section to include a discussion of implementation issues. Added a new section describing the simulator facilities available.

June 2, 1995 - ver 1.21

Added a paragraph to the TCP/IP Primer pointing out that multiple MTN packets can arrive contiguously. Changed the field name *equipment-code* in Type 01 and Type 05 messages to *request-code* to allow for a future change that expand the *unit-id* record in Type 04 messages to add *equipment-code* and *agency-code* fields. The paragraph labeled Unit Type Identification in Appendix G was changed to reflect the change and implementors should make the software changes suggested there as soon as it is convenient. Removed the one digit restriction from the description of the *equipment-count* field in Type 01 and Type 05 records. Changed the maximum length of the *unit-id* field in Type 04 messages and the Glossary from nine to six. A new Response codes table to was added to Appendix D. Added a paragraph to Appendix E stating that fields must not contain leading/trailing spaces. Appendix F:s two pages were combined onto a single page.

June 21, 1995 - ver 1.30

Renamed the *equipment-code* field in Type 01 and Type 05 messages to *requested-equipment-code* and retitled the table in Appendix D accordingly. Updated the description of the Thomas Bros. Map reference to reflect the impending change in map numbering.Enhanced Type 04 messages to be bidirectional. Added a *dispatched-equipment-code* field to Type 04 messages and added two new tables to Appendix D defining the new code values. Added a new Type 06 message to allow incident handoffs. Updated the example incident to include bidirectional Type 04 messages. Removed items from Appendix G that have now been made part of the specification.

November 11, 1995 - ver 1.31 Changed the format of the *position* field and changed the examples to match. Changed the *county-map-reference* field from fixed to variable length. The purpose of these changes is to remove the County specificity. Because none of the current clients supply a value in the *position* field no client reprogramming should be necessary. Servers should change their programming for this field at the earliest opportunity. Added a description of the location conversion software and data files now available.

December 13, 1995 - Ver 1.32 Added a proposal for reporting party information to the Request For Service message. Added a proposed Unit Service Status message.

January 15, 1996 - Ver 1.33

Proposals accepted with minor modifications: issued formally. Implementation date for message changes for servers will be agreed upon after discussions with server implementors. Page number for new style format Thomas Bros. map coordinates changed from three to four digits per new information from Thomas Bros..

October 27, 1998 - Ver 1.4

Added *EMD Determinant Code* field to Request For Service message. Changed Response Code definitions.

March 30, 2000 – Ver 1.41

Modified “Dispatched Equipment Codes” listing.

May 9, 2001 – Ver 1.41

Updated EMS Agency Address

January 22, 2002 – Ver 1.42

Added “E” to *Response Codes*. Revised *EMD Determinant* Codes.

March 1, 2005 – Ver 1.43

Deleted references to “repository” containing sample code and testing simulators

TABLE OF CONTENTS

DOCUMENTATION CONVENTIONS

The following conventions are used within this document:

Fields that are not otherwise delimited are surrounded by brackets ([]). The brackets are not part of the field and should not be included.

Italics are used within packet and record format specifications to indicate formal parameters that are to be replaced by a actual parameters.

Ellipsis (...) indicates that an item may be repeated zero or more times (e.g., *pathname*...). A short ellipsis (..) indicates all intervening items (e.g., 1..5).

A monospaced font is used to represent software related items and message formats.

Non-graphic ASCII characters are shown as `<ASCII-mnemonic>`. See Appendix A for the list of ASCII mnemonics.

1 MESSAGE TRANSMISSION NETWORK (MTN)

In an ideal world, as unrealistic as that may be, all of the participants in the MTN would be using compatible software systems with common database formats. The exact opposite is true currently. However, the hope is that by designing the MTN to use a common format for messages exchanged by participants it may be possible over time for the MTN to evolve into an ideal collection of systems where much of the software logic, if not actual source code and databases, can be centrally developed and shared among participants. Probably the most glaring example of a great potential savings in time and labor would be the establishment of a County-wide street and place names database for use by all County agencies.

The MTN is intended to automate the processing of requests between various EMS service providers and their clients, instead of using voice communication as is largely the case now. This will be accomplished by passing messages between the service requestors and service providers using a scheme that is loosely based on the currently trendy, but ill-defined, Client-Server model.

Some participating agencies, such as Walnut Creek P.D., may only act as Clients that request services from other agencies.

Some participating agencies, such as American Medical Response (AMR), will act as both Clients and Servers. For example, AMR primarily acts a Server, but if one of their units passes by an accident scene while traveling through another jurisdiction on the way to their call they will notify their dispatchers and the AMR CAD system will then act as a Client for the purpose of initiating an incident with the Server for that jurisdiction.

Theoretically an agency could act as only a Server, but no such situation exists currently.

To see how this system might work, let's look at the message flow that might be associated with a typical incident.

> A dispatching agency receives a call from a citizen reporting a possible heart attack victim. The dispatching agency creates an incident record that contains the details about the incident. A "request for ambulance" type message containing information about the incident is sent to an ambulance provider, say AMR. AMR creates a similar incident record on their system using the information in the message, sends a message acknowledging the request back to the incident originator, and then goes about the business of assigning an ambulance. When the ambulance assignment is made a status change message indicating that fact is sent to the incident originator. When the ambulance arrives on-scene a status change message is sent to the incident originator. During the incident additional messages will be exchanged regarding changes in the status of the incident (client to server) and of changes in the status of the ambulance (server to client). For example, AMR might discover that after the initial assignment another vehicle was closer and change the unit assignment. AMR would then send a status change type message to the incident originator. Likewise, the incident originator might get better information on the incident location and send a message to AMR with the revised location.

A key point to note here is that only two of the messages require a response or acknowledgment from the receiver. The other messages might not even be received if the receiver or its network connection is down,

or the receiver might choose to simply discard the message after logging it. If the sender of a message expects a response then it is the sender's responsibility to time out after some period and resort to alternative measures. In some cases where it is critical to determine whether the receiver is down special acknowledgment messages have been included in the design to shorten the time it takes to declare a server non-responsive. To illustrate this using the hypothetical example cited earlier, AMR's immediate response to an ambulance request is an acknowledgment message indicating that it has received the request and is in the process of assigning an ambulance. A short time-out should be used by a client while waiting for the initial response (e.g., 30 seconds), and a much longer timeout while waiting for the actual assignment message (e.g., a minute or two), before resorting to contingency plans.

But what about network failures? In this case, data that would have been obtained from other participants will have to be obtained using alternate networks, radio and telephone, and the incident record will have to be updated manually. Although much slower and lacking some of the detail of the automated method, the general information flow will be unchanged.

2 THE ROLE OF THE ACCJIN NETWORK

The MTN will operate using the TCP/IP-based ACCJIN network. All communication for the MTN will use TCP/IP's reliable stream service. Because this service is reliable, there is no need for synchronization bytes, or for parity or error correction schemes.

It is anticipated that most implementations will be done using a BSD Unix Sockets & Streams compatible Application Program Interface (API), although any other implementation that is compatible with the BSD Unix Sockets & Streams API is acceptable. A good example is the Windows Sockets & Streams API (aka WinSock).

Each MTN node that provides services will have a server that accepts calls from clients on the Well-Known Port `EMSMTN` (currently port 142).

Each MTN node that requires services will place calls to each service provider agency's `EMSMTN` port. Circuits will remain open until either the Client or Server closes the circuit (due to a crash or reboot), or until the network fails. If the network or a server fails then the Client should call Server periodically (no more often than every 10 seconds, no less often than once a minute) until the circuit can be re-established. Do not simply wait until you have a message to send before attempting to re-establish the circuit; the Server may need to send you messages regarding open incidents in the interim.

3 MTN DESIGN GOALS

The MTN is being designed with the following goals in mind:

Homogeneity

> All nodes participate equally in terms of the message passing; there is no *master node*. In reality, some nodes are logically more critical than others by virtue of the function that they perform (e.g., Servers).

Expandability

Care will be taken to avoid having the design of the MTN reflect the topography of the current EMS configuration. For example, there may be a time in the future when two or more ambulance providers are available. As a result the key role of the current primary service provider, AMR, will not be reflected in the design.

Robustness

Nodes will continue to operate while ACCJIN network is down, or while one or more other nodes on the network are down. This will be accomplished using backup "networks" such as radio and telephone. The MTN will be designed to be as immune as possible to the failure of any single node.

Node Vendor Immunity

To minimize long-term programming costs, both the way that messages are passed, and the format of the messages themselves, will be designed without regard to how each node vendor has programmed its node(s).

Establishment of Standards

The MTN will help to establish standards in two ways; by providing a model for message-based applications that might be developed in the future for other County applications, and by setting standards for items that are common to many County applications (e.g., incident identification schemes, street addresses and place names).

4 MTN STANDARD TIME

MTN Standard Time is recorded as the number of seconds since January 1st, 1900, Universal Coordinated Time (UTC), using an unsigned thirty-two bit integer. As it happens, this is the same time base used by TCP/IP. Using January 1st, 1900, as the time base allows for times to the nearest second until 10:28:15 p.m. PST on February 6, 2036. Using a time based on UTC has the advantage that time increases linearly without regard for Daylight Saving Time. Each node is responsible for converting MTN Standard Time to local time as needed.

For the sake of brevity, whenever MTN Standard Time is required within a message it will be transmitted over the network as a fixed length string of the form $d_1..d_{10}$, where d is a decimal digit (0..9). For example, Noon on January 26th, 1993, PST, would have been sent over the network as "2937067200". That corresponds to 20:00 on January 26th, UTC.

ANSI C includes a library function that converts calendar time to local time. In most cases all that's required to convert an MTN Standard Time to C calendar time is to correct the MTN Standard Time for the difference between Jan 1, 1900 and the base time used by your particular C. The most common C time base is the Unix time base of Jan 1, 1970. In this case subtracting the constant value `(70 * 365LU + 17) * 86400` from the MTN Standard Time and converting the resulting value to type `time_t` is all that's required. For other languages you will have to write specific functions for converting MTN Standard Time to local time, including correcting for Daylight Saving Time. A reference on how to accomplish this, including portable C source code that can be transcribed to your language, is *The Standard C Library*, P.J. Plauger, Prentice-Hall, 1992.

Unless you're running an operating system such as Unix that maintains system time as UTC, obtaining accurate calendar time from your operating system might be a problem even if you're using an ANSI C. Unfortunately, the ISO C Standard[1] specifies that "The local time zone and Daylight Saving Time are implementation-defined." The MS-DOS system clock is maintained as local time and even with the TIMEZONE or TZ environment variables set properly Microsoft C running under Windows 3.x or Windows for Workgroups 3.x and/or MS-DOS returns the wrong value for calendar time after Daylight Saving Time goes into effect until the system clock is advanced an hour. It is possible to write a daemon or TSR that takes care of advancing the system clock one hour and one second at precisely 01:59:59 local time on the first Sunday in April, but that only solves part of the problem. Due to a design error in the Microsoft C `time` function, obtaining an accurate calendar time between 01:00:00 and 01:59:59 local time on the day that Daylight Saving Time ends is not possible without a) adjusting the values returned by the time function to correct for Microsoft C's error between 01:00:00 and 01:59:59, and b) using the same daemon or TSR mentioned above to retard the time by fifty-nine minutes and fifty-nine seconds at precisely 01:59:59.

Several nodes on the ACCJIN network will be equipped with standard TCP/IP Time Servers from which you can obtain the current value of UTC within an accuracy of a few seconds, plus whatever network delays are involved in delivering the response from the time server. Typical delivery times are on the order of a hundred milliseconds so this should be sufficiently accurate for MTN needs. A typical procedure would be to request the time from each network host that provides a Time Server until a response is received. It is expected that this would only be required when restarting your node, or once every twenty-four hours, whichever occurs first. It is anticipated that the time at your node might drift a few seconds between checks with the Time Server, depending on the accuracy of the time-of-day clock hardware used by your node. This shouldn't cause any problems.

[1] Excerpted from ISO/IEC 9899:1990, section 7.12.1. Except for formatting differences the ANSI and ISO standards are identical.

5 MTN INCIDENT IDENTIFIER

Typically there will be two incident identifiers associated with each incident: the incident identifier used in MTN messages and the incident identifier maintained internally by each agency participating in the incident. Each participating agency is free to assign local incident identifiers using the format of their choice, as long as they have the ability to map local incident identifiers to/from MTN incident identifiers. This specification is only concerned with the format of MTN incident identifiers.

The format of an MTN incident identifier is:

[*originator*][*MTN-time*]

where:

originator is the three character mnemonic of the originating agency (see Agency codes on page D-1).
MTN-time is the MTN Standard Time, expressed as a ten character string of decimal digits, when the originating agency assigned its own local incident identifier.

Note: The time part of the incident identifier should not be assumed to have any relationship to the official start of the incident, or any other EMS epoch other than when the originating agency assigned its own local incident number. The time is used simply to guarantee unique (by virtue of the agency prefix and the rule that an agency not generate duplicate incident identifiers) monotonically increasing incident numbers County-wide without the need for a central agency to assign incident numbers. Comparing the time fields of two different agencies' incident numbers does not necessarily yield useful information; it might, but there is no guarantee.

6 MTN PACKET FORMAT

All MTN messages will be encapsulated in a common packet. The packet format is:

[*packet-type*][*MTN-message*]<EOT>

where:

packet-type is a character that indicates the type of packet. Only one packet type is currently defined; 'M' indicating Medical. Future packet types might be 'F' for Fire and 'A' for Administrative.
MTN-message is the MTN message being sent (see below).
<EOT> is the ASCII End Of Transmission character and delimits the packet from any other packet(s) that might immediately follow in the data stream.

Here's an example of the actual packets used during a simple Are You There, I Am Here exchange:

Sent: MI90<EOT>
Received: MI91<EOT>

7 MTN MESSAGE FORMAT

The seven bit ASCII character set is used for MTN messages. The entire character set is shown in Appendix A. The only non-graphic characters allowed within MTN messages are carriage control characters (HT, LF, VT, FF, CR, SP).

The format of an MTN message is:

[*MTN-message-class*][*MTN-message-text*]

where:

MTN-message-class is a single character that indicates the class of message that follows. Currently there is only one message class defined: '`I`' for Incident.
MTN-message-text is the actual message text.

MTN messages are composed of one or more records, with one or more fields within each record. The first field of the first record is typically a message sub-type indicator.

The general format of the MTN message text is:

MTN-record$_1$`<RS>`*MTN-record*$_2$`<RS>`...*MTN-record*$_n$`<RS>`

The format of an MTN record is:

MTN-field$_1$`<FS>`*MTN-field*$_2$`<FS>`...*MTN-field*$_n$

Although its ASCII definition is "File Separator", the '`<FS>`' delimiter can be thought of in this case as a "Field Separator".

When an '`<FS>`' would normally precede an '`<RS>`' then the '`<FS>`' can be omitted. The same is true when an '`<RS>`' would immediately precede an '`<EOT>`'. This rule may be applied recursively.

MTN message record and field formats are defined and described in Appendix E.

An actual packet requesting an ambulance from American Medical Response might look like this:[2]

```
MI01MTZ2664032901<FS>123321<RS>
G<FS>1<FS>MHA<FS>[C,D]<RS>
50<FS><FS>Glacier<FS>Dr<FS><FS>MTZ<RS>
<FS>Muir<FS>Rd<FS><FS>MTZ<FS><FS><RS>
<FS>EMS Building<FS>C010E06<FS>37.989,-122.086<FS>
G13 1543;546<FS><RS><RS>
Art Lathrop<FS>50 Glacier Dr., MTZ<FS>
510-646-4690<FS><RS>19C02<RS>10D01<EOT>
```

[2] NewLine characters have been used here to improve readability. The packet shown would normally be one long string of characters, although adding arbitrary carriage control characters after field and record separators is allowed. See page E-1.

Removing redundant field separators produces an equally legal, but slightly shorter, version of the packet:

```
MI01MTZ2664032901<FS>123321<RS>
G<FS>1<FS>MHA<FS>[C,D]<RS>
50<FS><FS>Glacier<FS>Dr<FS><FS>MTZ<RS>
<FS>Muir<FS>Rd<FS><FS>MTZ<RS>
<FS>EMS Building<FS>C010E06<FS>37.989,-122.086<FS>
G13 1543;546<RS>
A. Lathrop<FS>50 Glacier Dr., MTZ<FS>
510-646-4690<RS>19C02<FS>10D01<EOT>
```

8 MESSAGE LOGGING

Message logging occurs at each agency. This guarantees that messages will continue to be logged even when the network is unavailable.

Analyses of MTN message traffic will be accomplished by the network statistician obtaining copies of the log files periodically (days or weeks, not minutes or hours) from all nodes by whatever means is most convenient. The most likely method will be to use TCP/IP's File Transfer Protocol (FTP) to copy the log files from public directories at the agencies to the site where the analysis will be done.

It will simplify life greatly for the analysts if all log files are named using the same format. The proposed name format is `Mxmmdd.LOG`, where `M` indicates that the file is a log of type `M` packets, `x` is either '`C`' or '`S`' depending on whether the log contains client or server traffic, `mm` is the month (01..12), and `dd` is the day of the month (01..31). For example, the log file of medical packets at American Medical Response Co., which happens to be an MS-DOS system that acts as both a client and a server, for January 24th would be named '`MC0124.LOG`" and '`MS0124.LOG`".

Log files on Unix systems should use lower case letters. For example, Amc0124.log@ and Ams0124.log@.

A new log file should typically be started each night at midnight. Log files will be retained for a week after they've been copied to the analysis site in order to allow time for the analysis site to back up the log files. As we gain more experience about the average log file size and the operation of the analysis site the retention time may be shortened.

To conserve space and minimize transmission time log files may optionally be compressed using a Unix-compatible *compress*[3] utility. Compressed filenames are typically indicated by a "`.Z`" appended to the filename extension on systems that support multiple extensions (e.g., Unix), or by changing the last character of the extension to '`Z`' (e.g., "`.LOZ`") on systems that allow only a single filename extension (e.g., MS-DOS). Note that on Unix systems the A.Z@ extension is upper case.

The log file is a stream data file. The log file record format is:

[*flag*][*MTN-time*][*agency*][*MTN-packet*]
or: `N`[*MTN-time*][*free-text*]<`EOT`>

where:

[3] A public-domain copy of the C source code for the *compress* utility is available. Contact BJ, Inc., if you wish to obtain a copy.

flag is a single character indicating whether the message was sent ('S'), received ('R'), or was undeliverable ('U'). A message is undeliverable if the circuit to the recipient is down. As a minimum, note records (flag 'N') should be written upon startup, shutdown, and whenever you detect that a remote agency has closed its circuit. You can also generate note records for any other events you consider worth noting.
agency is the three character agency code (see the Agency Code table on page D-1) of the remote agency.
MTN-time is the MTN Standard Time when the message was sent or received, or the note was generated, expressed as an ten character string of decimal digits.
MTN-packet is the MTN packet described on page 6. Note that the definition of an MTN packet specifies that the final character is always an `EOT`.

Log records should contain an exact copy of the message packet that was sent or received. Received records should be logged immediately after delivery to the CAD system has been attempted (using an 'R' flag, or a 'U' if you can determine that your CAD is down). Sent records should be logged immediately after delivery to the network has succeeded or failed (use the result of the TCP/IP `send()` function to determine whether to log it with an 'S' or 'U' flag). Note that it is understood that 'R' and 'S' flags are not unequivocal indications that delivery has succeeded; a delivery failure might not actually be detected until some time later.

9 EAVESDROPPING

The Contra Costa County Sheriffs Office is charged with the responsibility for monitoring the current status of all units involved with EMS. In addition, ALCO has situations where two dispatch centers can dispatch a particular unit. The eavesdrop facility was developed to address these two issues.

In order to accomplish this each agency that provides an EMS server is required to monitor Well-Known Port `EMSSED` (EMS Server EavesDrop, currently port 143) for incoming calls and accept all that occur, except in the case of an agency attempting to open more than one eavesdrop circuit at the same time.

Until the eavesdrop circuit is closed the server will echo all its log records to it, minus the timestamp. For example, a type 90/91 exchange between CFD as client and AMR as server would cause AMR to send the following two messages to each active eavesdrop port:

```
RCFDMI90<EOT>
SCFDMI91<EOT>
```

If any network error is detected then the server should just close that eavesdrop circuit and resume listening for incoming calls. The server must allow for multiple eavesdrop circuits to be active simultaneously, up to a limit of one per agency.

Unlike normal MTN circuits that have traffic going in both directions, traffic on eavesdrop circuits is only toward the caller. Any data sent to an eavesdrop server will be discarded by the server.

The eavesdrop facility is not intended for casual use due to the additional network traffic load involved. Occasional use by agencies while debugging their client software, or for use in demonstrations, is not an unreasonable use.

GLOSSARY

Field — The term used to describe a fundamental data item. Variable length fields are delimited by a '<FS>' (field separator) character. Also see Record.

Free Text — The term used to describe a field whose content is unstructured. Free text can contain any ASCII graphic characters, space, and the control codes HT, LF, VT, FF and CR.

Message — The term used to describe collection of records and fields sent or received as a unit between a pair of agencies via MTN in order to exchange information. Also see Packet.

Null Field — A field that has no characters before the '<FS>' delimiter. Used to indicate that no data is available for the field, or that data sent previously in the field is still valid.

Null Record — A record that has no characters before the '<RS>' delimiter. Used to indicate that no data is available for the record, or that data sent previously in the record is still valid.

Packet — The term used to describe a message that is prefixed with header information added at the network driver level by the sender and stripped at the network driver level by the recipient before delivery to the CAD software. The primary purpose of adding a "wrapper" to messages to form a packet before transmission is to allow for the use of EMS circuits by non-CAD applications in the future, and to allow routing of messages by front-end processors without requiring that the front-end processor software know the format of the message encapsulated by the packet. Also see Message.

Record — A group of associated fields. Records are delimited using a '<RS>' (record separator) character. e.g., a location record composed of address information fields. Also see Field.

Unit — The term used to refer to a piece of dispatchable equipment, such as an ambulance, fire truck, or helicopter. Also see Unit ID.

Unit ID — Units are identified by one to six character unit ID that is usually unique to the agency that operates the unit, but is not necessarily unique County-wide. Also see Unit.

APPENDIX A - SEVEN BIT ASCII CHARACTER SET

The graphic characters in the range between 041 and 176 octal are:

```
          0123456701234567012345670123456 7
040        !"#$%&'()*+,-./0123456789:;<=>?
100       @ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_
140       `abcdefghijklmnopqrstuvwxyz{|}~
```

The decimal version is:

```
          01234567890123456789012345 6789
30           !"#$%&'()*+,-./0123456789:;
60        <=>?@ABCDEFGHIJKLMNOPQRSTUVWXY
90        Z[\]^_`abcdefghijklmnopqrstuvw
120       xyz{|}~
```

The hexadecimal version is:

```
          0123456789ABCDEF0123456789ABCDEF
20         !"#$%&'()*+,-./0123456789:;<=>?
40        @ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_
60        `abcdefghijklmnopqrstuvwxyz{|}~
```

The following table shows the mnemonics that will be used for the non-graphic characters in the seven bit ASCII character set.

Mnem	Oct	Dec	Hex	Description
NUL	000	0	00	NULl
SOH	001	1	01	Start Of Header
STX	002	2	02	Start of TeXt
ETX	003	3	03	End of TeXt
EOT	004	4	04	End Of Transmission
ENQ	005	5	05	ENQuiry
ACK	006	6	06	positive ACKnowledge
BEL	007	7	07	BELl
BS	010	8	08	BackSpace
HT	011	9	09	Horizontal Tabulation
LF	012	10	0A	Line Feed
VT	013	11	0B	Vertical Tabulation
FF	014	12	0C	Form Feed
CR	015	13	0D	Carriage Return
SO	016	14	0E	Shift-Out
SI	017	15	0F	Shift-In
DLE	020	16	10	Data Link Escape
DC1	021	17	11	Device Control 1
DC2	022	18	12	Device Control 2
DC3	023	19	13	Device Control 3
DC4	024	20	14	Device Control 4
NAK	025	21	15	Negative AcKnowledge

Mnem	Oct	Dec	Hex	Description
SYN	026	22	16	SYNchronous idle
ETB	027	23	17	End of Transmission Block
CAN	030	24	18	CANcel
EM	031	25	19	End of Medium
SUB	032	26	1A	SUBstitute character
ESC	033	27	1B	ESCape
FS	034	28	1C	File Separator (IS4[4])
GS	035	29	1D	Group Separator (IS3)
RS	036	30	1E	Record Separator (IS2)
US	037	31	1F	Unit Separator (IS1)
SP	040	32	20	SPace
DEL	177	127	7F	DELete

[4] The ASCII seven bit character set differs only slightly from the ISO Recommendation T.50. IS1..4 are the only differences.

APPENDIX B - A TCP/IP PRIMER

The switched telephone network is an appropriate metaphor for the way that TCP/IP works. Consider the following similarities:

> You can place a call to anyone as long as you know their "number".
>
> You can receive calls from anyone who knows your "number".
>
> The circuit connecting you and the other party is full-duplex which means that you can both talk simultaneously, or you can both listen simultaneously, or one of you can talk while the other listens.
>
> The circuit is point-to-point. An equivalent to the old party-line telephone circuit (i.e., broadcast) is available as part of TCP/IP, but not as part of reliable stream service.
>
> You can end a call (i.e., hang up) when the conversation is over, or you can just lay the handset down beside the phone in case you need to talk again later and don't want to take the time to dial the phone and establish a new connection.
>
> If the person you're talking to hangs up the phone or the telephone line breaks then you get an indication that something's wrong. Even the way that you discover the connection has been broken is similar; if you're talking at the time you get an immediate indication, otherwise you find out the next time you try to talk[5].
>
> As with telephone networks, TCP/IP networks can be private, public, or hybrid (a private network hiding behind a gateway system that's connected to a public network). The most extensive public TCP/IP network is known as the Internet.

But there are also a few minor differences:

> To call somebody you need two numbers. It's similar to calling somebody at their office when you have their office phone number and their phone extension number. In the case of TCP/IP, the host address corresponds to the office phone number and the port number corresponds to the phone extension number. To make life easier, TCP/IP provides a facility for aliasing the office phone numbers (host names) and extensions (service names) using alphanumeric mnemonics.
>
> Unlike a typical household with one or two phone lines, or even an office phone with six or eight lines, you can have quite a few connections active simultaneously. Exactly how many depends on your particular implementation of TCP/IP.

When thinking about how MTN will operate using TCP/IP you can safely fall back on this telephone metaphor. Just think of each agency having a separate telephone, each connected to a separate EMS agency. You know who your talking to, or who's talking to you, simply by virtue of which telephone you're using.

---

[5] If you choose to use a Sockets & Streams style interface to TCP/IP then you can elect to be notified immediately when a remote host explicitly closes a circuit.

As to the question of who calls who, the answer is that Clients call Servers, and Servers answer calls from Clients. Clients don't answer calls and Servers don't place calls.

Every implementation of TCP/IP supports the low-level routines that are used to place a call (dial), listen for incoming calls (ringing), accept a call (pick up the phone), reject a call (don't pick up the phone), and end a call (hang up the phone). Because the act of handling a circuit is inherently multi-threaded, and Unix does not support multi-threaded processes, a special library was developed for BSD Unix that allows a single threaded program to handle multiple circuits simultaneously. This library is known as the Sockets & Streams library and it is supported by virtually every TCP/IP implementation, including all flavors of Unix, VAX/VMS, VM, MS-DOS and Windows. An important feature of the Sockets & Streams design is that all subroutine calls can operate as either pended or unpended calls.

As with most modern packet-based networks, TCP/IP attempts to combine multiple data packets destined for a particular remote host into a single frame for the sake of efficiency. In addition, routing delays at nodes traversed along the way can cause data packets from the same or different sending hosts to arrive at the destination host simultaneously. Also, TCP/IP breaks up large data packets into whatever size will fit into the space left in the frame so that MTN packets will occasionally span frames. All that TCP/IP guarantees is that data arriving on a particular virtual circuit will be presented in the same sequence that it was sent. The effect of this is that when issuing a receive you might find several MTN packets stored contiguously in your receive buffer, or just a partial MTN packet. You should not assume that each receive will result in a single MTN packet. Instead you should treat the received data as a stream and scan for the <EOT> character that delimits an MTN packet before processing it and continuing the scan.

APPENDIX C - MTN SPECIFICATION FILE

MTN SPECIFICATION FILE

This specification is maintained using Windows 98 and Word 2000. True Type fonts are used so that the document will look the same no matter what kind of Windows printer driver is used.

The Word 2000 format file of this specification is available on the EMS web site at http://www.cccems.org.

APPENDIX D - STANDARD CODE TABLES

The following tables document the codes used for the EMS MTN.

Participating agency codes:

Code	Agency
AMR	American Medical Response, West
ANT	Antioch P.D.
CFD	CoCoCo Fire District
CON	Concord P.D.
EBR	East Bay Reg'l P.D.
MOR	Moraga P.D.
MSC	Message Switching Computer
MTZ	Martinez P.D.
PHL	Pleasant Hill P.D.
RPD	Richmond P.D.
SOD	Sheriffs Office Dispatch
SOT	Sheriffs Office Dispatch - Test
SRM	San Ramon P.D.
WAL	Walnut Creek P.D.
WBY	West Bay Communications

(some agency codes associated with unit-ids are not yet listed, but will be eventually)

Pre & post street directions:

Code	Direction
E	East
N	North
NE	Northeast
NW	Northwest
S	South
SE	Southeast
SW	Southwest
W	West

Street type codes:

Code	Type
AV	Avenue
BL	Boulevard
CR	Circle
CT	Court
DR	Drive
HW	Highway
LN	Lane
LP	Loop
PW	Parkway
PL	Place
PZ	Plaza
RD	Road
SQ	Square
ST	Street
TE	Terrace
WY	Way

Street types not shown in this table (e.g., Crescent) must be spelled out in the address field.

Community codes:

Code	Community
AC	Alameda County
AL	Alamo
ALB	Albany
ANT	Antioch
BN	Benicia
BK	Berkeley
BI	Bethel Island
BL	Blackhawk
BP	Bay Point
BW	Brentwood
BY	Byron
CA	Canyon
CV	Castro Valley
CL	Clayton
CCC	Contra Costa County
CON	Concord
CR	Crockett
CY	Clyde
DA	Danville
DB	Discovery Bay
DI	Diablo
DU	Dublin
EC	El Cerrito
ES	El Sobrante
HE	Hercules
KE	Kensington
KN	Knightsen
LA	Lafayette
LI	Livermore
MTZ	Martinez
MO	Moraga
OY	Oakley
OA	Oakland
OR	Orinda
PA	Pacheco
PC	Port Costa
PHL	Pleasant Hill
PL	Pleasanton
PIN	Pinole
PIT	Pittsburg
RIC	Richmond
RV	Rio Vista
RO	Rodeo
SA	Sacramento County
SQ	San Joaquin County
SP	San Pablo
SR	San Ramon
SO	Solano County
TR	Tracy
VA	Vallejo
WAL	Walnut Creek

Destination codes:

Code	Destination
000000	Unknown
010739	Alta Bates Hospital
010776	Chi1dren's Hospital - Oakland
010805	Eden Hospital
010846	Highland Hospital
010856	Kaiser - Oakland
010983	Valley Memorial - Livermore
013626	Summit Medical Center
210992	Kaiser - San Rafael
211006	Marin General
480989	Kaiser - Vallejo
481015	First Hospital - Vallejo
481094	Sutter Solano Hospital
070904	Brookside Hospital
070924	Merrithew Memorial Hospital
070934	Delta Memorial Hospital
070988	John Muir Hospital
070990	Kaiser Fdn Hsp - Walnut Creek
070991	Kaiser Fdn Hsp - Richmond
071010	Kaiser Fdn Hsp - Martinez
071018	Mt. Diablo Hospital
071032	Oak Grove Hospital
071053	East Bay Hospital
071101	CPC Walnut Creek Hospital
073449	Doctors - Pinole
073638	Los Medanos Community Hospital
074011	Golden State Rehab Hospital
074017	San Ramon Reg'l Med Ctr.

Requested equipment codes:

Code	Request
A	ALS ambulance
B	BLS ambulance
C	ALS responder
D	BLS responder
F	Fire medical Response unit
G	Any transport unit
H	Air ambulance
J	Marine transport
K	Off road transport
L	Law enforcement
M	Multi-casualty unit
N	Non-medical transport
P	Basic fire (engine)
Q	Fire rescue unit
S	Medical supervisor
U	Strike team
V	Task force
X	Medical cache
Y	Rescue helicopter
Z	Hazmat team
1..9	Agency defined equipment

Response codes:

Code	Response
A, B, C, D, E, O	Response to be determined by EMD program.

Incident & response codes:

Code	Code	Incident
ACC	2,3	Other accident (bus, plane, etc.)
MAA	3	Medical alert alarm
MAB	2,3	Abdominal pain
MAI	2,3	Alcohol intoxication
MAL	2,3	Allergic reaction
MAM	3	Amputation of body part
MAP	2,3	Auto/pedestrian accident
MAS	2,3	Assault victim
MBI	2,3	Bite (animal/human/reptile)
MBL	2,3	Bleeding problem
MBP	2,3	Back pain
MBV	2,3	Burn victim
MCA	3	Cardiac arrest
MCH	2,3	Choking
MCP	2,3	Chest pain
MDB	2,3	Difficult breathing
MDO	2,3	Disorientation
MDP	2,3	Diabetic problem
MDR	2,3	Drowning/submersion
MDZ	2,3	Dizziness/fainting
MEI	2,3	Extremity injury
MEL	2,3	Electrocution
MEX	2,3	Exposure
MEY	2,3	Eye injury/problem
MFA	2,3	Fall
MFE	2,3	Fever/elevated temperature
MFP	2,3	Fast pulse rate
MGW	2,3	Gunshot wound
MHA	2,3	Heart attack
MHE	2,3	Headache
MHI	2,3	Head injury
MHP	2,3	High blood pressure
MIA	2,3	Industrial accident
MIG	2,3	Indigestion - sever
MIJ	3	Major injuries
MIM	2	Minor injuries
MIO	2,3	Impaled object
MKN	2,3	Knife wound
MLA	2,3	Childbirth - labor/contractions
MLV	2,3	Loss of vision
MNB	3	Non-breather
MOB	2,3	Birth in progress
MOD	2,3	Overdose
MPA	2,3	Unable to move
MPD	2,3	Person down
MPO	2,3	Poisoning
MPP	2,3	Pregnancy problems
MPR	2,3	Police request/ambulance only
MPS	2,3	Psychiatric problems
MRE	2,3	Rescue
MSF	2,3	Structure fire/fire incident
MSK	2,3	Sick person
MSP	2,3	Slow pulse
MSS	2,3	Slurred speech
MST	3	Stabbing
MSU	3	Suicide victim
MSZ	2,3	Seizure/convulsions
MTO	2,3	Toxic substance exposure
MTR	2,3	Trauma victim
MUM	3	Unknown medical
MUN	3	Unconscious person
MVA	2,3	Vehicle accident
MVO	2,3	Vomiting
OTH	2,3	Other incident
TST	2,3	Test incident

EMD Determinant Codes:

The full code is of the form XXYZZn, where XX indicates the general call type category, Y indicates the level of response being requested (A, B, C, D, E, O), ZZ indicates the specific call type category, and n is qualifier for certain call types. For example, a call with for an electrocution where the victim was unconscious would be expressed as code 15D01E.

01 - Abdominal Pain/Problems

A01 - Abdominal Pain
C01 - Fainting or near fainting >= 50
C02 - Females with fainting or near fainting 12-50
C03 - Males with pain above navel >=35
C04 - Females with pain above navel >=45
D01 – Not alert

02 - Allergies/(Reactions)/Envenomations (Stings, Bites)

A01 - No difficulty breathing or swallowing (rash, hives or itching may be present)
A02 – Spider bite
B01 - Unknown status (3rd party situation)
C01 - Difficulty breathing or swallowing
C02 – Special medications or injections used
D01 - Severe Respiratory Distress
D02 - Not alert
D03 - Condition worsening
D04 – Swarming ATTACK (bee, wasp, hornet)
D05 – Snakebite
E01 – Ineffective Breathing

03 - Animal Bites/Attacks

A01 – Not dangerous body area
A02 – Non-recent injuries (>= 6 hours)
A03 - Superficial bites
B01 - Possible dangerous body area
B02 – Serious hemorrhage
B03 - Unknown injuries (3rd party situation)
D01 - Unconscious or arrest
D02 – Not alert
D03 - Dangerous body area
D04 - Large animal
D05 - Exotic animal
D06 - Attack or multiple animals

04 - Assault/Sexual Assault *(A or S suffix)*

A01 - Not dangerous body area
A02 - Non-recent injuries (>= 6 hours)
B01 - Possibly dangerous body area
B02 - Serious hemorrhage
B03 - Unknown status (3rd party caller)
D01 - Unconscious or arrest
D02 - Not alert
D03 - Abnormal breathing
D04 - Dangerous body area
D05 – Multiple victims

05 - Back Pain (Non-traumatic or Non-recent trauma)

A01 - Non-traumatic back pain
A02 - Non-recent traumatic back pain (>= 6 hours)
C01 - Fainting or near fainting (age >= 50)
D01 - Not alert

06 - Breathing Problems

C01 - Abnormal breathing
C02 - Cardiac history
D01 - Severe respiratory distress
D02 - Not alert
D03 - Clammy
E01 – Ineffective Breathing

07 – Burns (Scalds)/Explosion

A01 - Burns <18% body area
A02 – Fire alarm (unknown situation)
A03 - Sunburn or minor burns (<= hand size)
B01 - Unknown status (3rd party caller)
C01 - Building fire with persons reported inside
C02 - Difficulty breathing
C03 – Burns >= 18% body area
D01 -Unconscious or arrest
D02 - Severe Respiratory distress
D03 - Not alert
D04 – Explosion
D05 – Multiple victims

08 - Carbon Monoxide/Inhalation/HazMat

A01 – C.O. detector alarm (without priority symptoms)
B01 - Alert without difficulty breathing
C01 - Alert with difficulty breathing
D01 - Unconscious or arrest
D02 - Severe respiratory arrest
D03 - Hazmat
D04 - Not alert
D05 – Multiple victims
D06 – Unknown status (3rd party caller)

09 – Cardiac or Respiratory Arrest/Death

O01 – Expected death (unquestionable)
B01 - Obvious death situation (unquestionable)
D01 - Ineffective breathing
E01 – Not breathing at all
E02 – Breathing uncertain (agonal)
E03 – Hanging
E04 – Strangulation
E05 – Suffocation
E06 - Underwater

10 - Chest Pain

A01 - Normal breathing (age < 35)
C01 - Abnormal breathing
C02 - Cardiac history
C03 - Cocaine
C04 - Breathing normally >= 35
D01 - Severe respiratory distress
D02 - Not alert
D03 - Clammy

11 - Choking

A01 - Not choking now (can talk or cry , is alert and breathing normally)
D01 – Not Alert
D02 - Abnormal breathing (partial obstruction)
E01 – Choking verified/Ineffective breathing

12 - Convulsions/Seizures

A01 - Not seizing now and breathing regularly (verified)
B01 - Breathing regularly not verified < 35
C01 - Pregnancy
C02 - Diabetic
C03 - Cardiac history
D01 - Not breathing
D02 - Continuous or multiple seizures
D03 - Irregular breathing
D04 – Breathing regularly not verified >= 35

13 - Diabetic Problems

A01 - Alert
C01 - Not alert
C02 - Abnormal behavior
C03 – Abnormal breathing
D01 - Unconscious

14 - Drowning (near)/Diving/Scuba Accident

A01 - Alert and breathing normally (no injuries and out of water)
B01 - Alert and breathing normally (injuries or in water)
B02 - Unknown status (3rd party caller)
C01 - Alert with abnormal breathing
D01 - Unconcious
D02 - Not alert
D03 - Diving or suspected neck injury
D04 - SCUBA accident

15 - Electrocution/Lightning *(E or L suffix)*

C01 - Alert and breathing normally
D01 - Unconscious
D02 - Not disconnected from power
D03 - Power not off/Hazard present
D04 - Long fall
D05 - Not alert
D06 - Abnormal breathing
D07 - Unknown status (3rd party caller)
E01 – Not breathing/Ineffective breathing

16 - Eye Problems/Injuries

A01 - Moderate eye injuries
A02 - Minor eye injuries
A03 – Medical eye problems
B01 - Severe eye injuries
D01 - Not alert

17 - Falls

O01 – Public assist (no injuries and no priority symptoms)
A01 - Not dangerous body area
A02 - Non-recent injuries (>= 6 hours)
B01 - Possibly dangerous body area
B02 - Serious hemorrhage
B03 - Unknown status (3rd party caller)
D01 - Dangerous body area
D02 - Long fall (>= 6 ft/2m)
D03 - Not alert
D04 - Abnormal breathing

18 - Headache

A01 - Breathing normally
B01 – Unknown status (3rd party caller)
C01 - Not alert
C02 - Abnormal breathing
C03 - Speech problems
C04 - Sudden onset of severe pain (<= 3 hours)
C05 - Numbness or paralysis
C06 – Change in behavior (<= 3 hours)

19 - Heart Problems/A.I.C.D.

A01 - Heart rate >= 50 bpm and < 130 bpm (without priority symptoms)
A02 – Chest pain < 35 (without priority symptoms)
B01 - Unknown status (3rd party caller)
C01 - Firing of A.I.C.D.
C02 - Abnormal breathing
C03 - Chest pain >= 35
C04 – Cardiac history
C05 – Cocaine
C06 – Heart reate < 50 bpm or >= 13 bpm (without priority symptoms)
D01 - Severe respiratory distress
D02 – Not alert
D03 - Clammy

20 - Heat/Cold Exposure

A01 - Alert
B01 - Change in skin color
B02 - Unknown status (3rd party caller)
C01 - Cardiac history
D01 - Not alert

21 - Hemorrhage/Lacerations

A01 - Not dangerous hemorrhage
A02 – Minor hemorrhage
B01 - Possibly dangerous hemorrhage
B02 – Serious hemorrhage
B03 – Bleeding disorder or blood thinners
C01 – Hemorrhage through tubes
D01 - Dangerous hemorrhage
D02 - Not alert
D03 - Abnormal breathing

22 - Industrial/Machinery Accidents

B01 - Unknown situation (not caught in machinery)
D01 - Life status questionable
D02 - Caught in machinery (unknown status)
D03 - Multiple victims

23 - Overdose/Poisoning (Ingestion)

(O or P suffix)

O01 - Poisoning (without priority symptoms)
B01 - Overdose (without priority symptoms)
C01 - Violent (police must secure)
C02 - Not alert
C03 - Abnormal breathing
C04 – Antidepressants (tricyclic)
C05 - Cocaine (or derivative)
C06 – Narcotics (heroin)
C07 – Acid or alkali (lye)
C08 – Unknown status (3rd party caller)

C09 – Poison Control request for response
D01 - Unconscious
D02 - Severe respiratory distress

24 - Pregnancy/Childbirth/Miscarriage

A01 - 1st trimester hemorrhage or miscarriage
B01 - Labor (delivery not imminent, >= 5 months/20 weeks)
B02 - Unknown status (3rd party caller)
C01 - 2nd trimester hemorrhage or miscarriage
C02 – 1st trimester serious hemorrhage
D01 - Breech or cord
D02 – Head visible/out
D03 - Imminent delivery (>= 5 months/20 weeks)
D04 - 3rd trimester hemorrhage
D05 - High risk complications
D06 – Baby born

25 - Psychiatric/Abnormal Behavior/Suicide Attempt

A01 - Non-violent and non-suicidal (alert)
B01 - Violent (police must secure)
B02 – Threatening suicide
B03 – Near hanging, strangulation, or suffocation (alert)
B04 – Unknown status (3rd party caller)
D01 - Not alert

26 - Sick Person (Specific Diagnosis)

A01 - No priority symptoms (complaint conditions 2 - 28 not identified)
A02 - 28 - Various non-priority complaints
B01 - Unknown status (3rd party caller)
C01 - Cardiac history (complaint conditions 2-28 not identified)
D01 – Not alert

27 - Stab/Gunshot/Penetrating Trauma

(S, G or P suffix)

A01 - Non-recent peripheral wound (>= 6 hours)
B01 - Non-recent single central wound (>= 6 hours)
B02 – Known single peripheral wound
B03 – Serious hemorrhage
B03 - Unknown status (3rd party caller)
D01 - Unconscious or arrest
D02 - Not alert
D03 – Central wounds
D04 - Multiple wounds
D05 – Multiple victims

28 - Stroke (CVA)

A01 - Breathing normally < 35
B01 - Unknown status (3rd party caller)
C01 - Not alert
C02 - Abnormal breathing
C03 – Speech or movement problems
C04 – Numbness or tingling
C05 – Stroke history
C06 – Breathing normally >= 35

29 – Traffic/Transportation Accidents

A01 - 1st party caller with injury to not dangerous body area
B01 - Injuries
B02 - Multiple victims (one unit)
B03 – Multiple victims (additional units)
B04 – Serious hemorrhage
B05 – Unknown status (3rd party caller)
D01 - Major incident
D02 - High mechanism
D03 - Hazmat
D04 – Pinned (trapped) victim
D05 - Not alert

30 - Traumatic Injuries (Specific)

A01 - Not dangerous body area
A02 - Non-recent injuries (>= 6 hours)
B01 - Possibly dangerous body area
B02 - Serious hemorrhage
D01 - Dangerous body area
D02 - Not alert
D03 – Abnormal breathing

31 - Unconscious/Fainting (Near)

A01 - Single or near fainting episode and alert (age < 35)
C01 - Alert with abnormal breathing
C02 - Cardiac history
C03 - Multiple fainting episodes
C04 - Single or near fainting episode and alert >= 35
C05 - Females 12-50 with abdominal pain
D01 - Unconscious (at end of interrogation)
D02 - Severe respiratory distress
D03 - Not alert
E01 – Ineffective breathing

32 - Unknown Problem (Man Down)

B01 - Standing, sitting, moving or talking
B02 - Medical Alert notifications
B03 - Unknown status (3rd party caller)
D01 - Life status questionable

33 – Interfacility/Palliative Care

A01 – Acuity I (no priority symptoms)
A02 - Acuity II (no priority symptoms)
A03 - Acuity III (no priority symptoms)
C01 – Not alert (acute change)
C02 – Abnormal breathing (acute onset)
C03 – Significant hemorrhage or shock
C04 – Possible acute heart problems or MI (heart attack)
C05 – Acute severe pain
C06 – Emergency response requested
D01 – Suspected cardiac or respiratory arrest

Dispatched equipment codes:

The full code is of the form `XYY[n]`, where `X` indicates the EMS capability being provided, `YY` indicates the category of equipment being provided, and `n` is the type of equipment within a category. For example, a type 3 engine with BLS advanced airway capability would be expressed as code `CEN3`.

The EMS capability codes are:

A	ALS
B	BLS
C	BLS - advanced airway
D	BLS - defibrillation
F	First aid (below BLS)
N	Non-medical

In the list of possible capabilities for each type of equipment in the following table the default capability is bold.

Code	Capability	Equipment
AC	**B**F	Airport crash rescue
AM	**A**BCD	Ambulance
BS	F**N**	Breathing support type 1
ENn	ABC**D**F	Engine type n, n=1,3,.4
FB	B**F**N	Fire boat
HF	B**N**	Helicopter - fire
HM	**A**B	Helicopter - medical
HZ	B**F**N	Hazmat type 1
MC	**B**F	Multicasualty unit type 1
MS	**N**	Miscellaneous
SA	B**N**	Salvage Unit type 1
SU	AB**F**N	Supervisor, BC, Chief, ambulance supervisor
TRn	B**D**F	Truck type n, n=1,2
US	A**B**	USAR type 2
WTn	B,**F**,N	Water tender type n, n=1,2

APPENDIX E - MTN MESSAGE DESCRIPTIONS

This appendix describes both the use and format of MTN messages.

MTN messages are composed of both fixed and variable length records and fields. Variable length records and fields are delimited for parsing purposes, as described on page 6. Adjacent fixed length fields are not delimited unless a null field is possible.

Field separators and record separators, as specified in the message formats that follow, are always present, even if the field or record is null. A null field or record means that the corresponding field or record is unchanged from its previous value. Initially, all fields are blank.

Carriage control characters (i.e., HT, LF, VT, FF, and CR) that occur immediately after a field or record separator or after an EOT are allowed to improve log file readability and to provide for systems that can only do line-oriented I/O and should be ignored when parsing messages. Carriage control characters should not occur within any data field except for free text fields. The primary intention of allowing carriage control characters after delimiters is to make log and trace files more readable, but they should be used sparingly (e.g., only after record separator characters). The reason for allowing carriage control characters in free text fields is to provide for sending text formatted for a printer. Receivers are free to remove and discard all carriage control characters occurring in free text fields before processing them.

Field values should not contain leading and/or trailing spaces.

Non-code text fields (e.g., free text and street and city names) can be mixed upper and lower case, or all upper case.

There are no minimum or maximum lengths associated with many of the variable length text fields. Implementors are free to truncate incoming variable length text fields to whatever length is appropriate for their system, to discard unneeded fields, and to send variable length text fields of whatever length they choose, including a null field if appropriate. Strictly speaking there is no maximum length for many MTN messages, but because it simplifies programming to receive an entire message before parsing it, an arbitrary maximum message length of 4000 characters is imposed.

New fields and records will always be added at the end of records and messages. To allow for unsynchronized implementation of new messages, fields and records parsers should simply log and ignore unrecognized message types and ignore any additional fields at the end of records and additional records at the end of messages. This will allow for continued operation during unsynchronized software upgrades to incorporate new message types, fields, and records.

Type 01 - Request For Service

This discretionary message is sent to a service provider announcing a new incident and requesting a service. The required response from the service provider is an immediate Type 02 message (no more than ten seconds).

Note that there will only be one Type 01 message sent for a particular MTN incident id. Subsequent communication regarding the MTN incident id will use only Type 02 or higher message types. If a subsequent Type 01 message with the same MTN incident number is received (possible if the sender does not receive a timely Type 02 response and attempts to retry) then it should be reported to supervisory personnel and ignored.

The message format is:

`01`[*MTN-incident-id*]`<FS>`[*requestor-incident-id*]`<RS>`
[*requested-equipment-code*]`<FS>`[*equipment-count*]`<FS>`[*incident-code*]`<FS>`
[*response-code*]`<RS>`[*location-record*]`<RS>`[*free-text*]`<RS>`[*rp-record*]`<RS>`
[*EMD-determinant-code*]

where:

`01` is the two character message type.
MTN-incident-id is the required MTN incident id (see page 5).
requestor-incident-id is the optional identifier assigned to the incident by the requestor. It can be up to ten characters long.
requested-equipment-code is an optional code that identifies the type of equipment requested (see page D-3). If this field is null then the service provider must infer the equipment requested based on the *incident-code* and *response-code* fields, and any supplementary text in the *free-text* record.
equipment-count is a required numeric value that indicates the number of pieces of equipment being requested. All equipment provided will be of the same type. If two or more different types of equipment are required then a Type 05 message should be sent for each other type of equipment requested after the Type 02 acknowledgment message has been received.
incident-code is a required three character code that identifies the type of incident involved (see page D-3). An *incident-code* of `TST` indicates a test message. All service provider dispatchers should be advised to avoid dispatching any units for test incidents and traffic analysis software should ignore all traffic associated with test incidents.
response-code is a required one character code indicating the level of response (see page D-3). Until all current implementations are upgraded to the new response codes (O, A, B, C, D), any call coded O, A or B will be considered a Code 2 call and any call coded C or D will be considered a Code 3 call.
location-record is a required record that specifies the location of the incident (see below).
free-text is an optional field providing supplementary information.
rp-record is an optional record that specifies the reporting party.
EMD-determinant code is a required record that provides additional information for responding personnel regarding the incident type (see page D-4).

The *location-record* format is:

[*street-address-record*]<RS>[*cross-street-record*]<RS>[*additional-information*]

where:

street-address-record format is:

[*number*]<FS>[*pre-direction*]<FS>[*name*]<FS>[*type*]<FS>
[*post-direction*]<FS>[*community*]

cross-street-record format is:

[*pre-direction*]<FS>[*name*]<FS>[*type*]<FS>
[*post-direction*]<FS>[*community*]<FS>
[*pre-direction*]<FS>[*name*]<FS>[*type*]<FS>
[*post-direction*]<FS>[*community*]

additional-information format is:

[*apartment-number*]<FS>[*common-place-name*]<FS>
[*Thomas-Bros-map-reference*]<FS>[*position*]<FS>
[*county-map-reference*]<FS>[*additional-location*]

The maximum field lengths are:

number	6
pre-direction	2
name	30
type	2, fixed
post-direction	2
community	3
apartment-number	6
common-place-name	30
Thomas-Bros-map-reference	7, fixed
position	17, variable
county-map-reference	13, variable
additional-location	30

number is a required variable length field that contains the street address number of the location: e.g., `1234`.
pre-direction is an optional one or two character field that contains the direction prefix code (see page D-1).
name is a required variable length field that contains the name of the street: e.g., "`North Gate`".
type is an optional two character field that contains the street type code (see page D-1).
post-direction is an optional one or two character field that contains the direction suffix code (see page D-1).
community is a required two or three character field that contains the community code (see page D-2).
apartment-number is an optional variable length field that contains the apartment or unit number at the location: e.g., "`2A`".
common-place-name is an optional variable length field that contains the generic description of the location: e.g., "`Sun Valley Mall`".
NOTE: At least one of the following three fields must be supplied.
Thomas-Bros-map-reference is the fixed length Thomas Bros. map book reference. There are two possible formats: old style and new style.The old style format is `mpppcr`, where `m` is the map indicator

(currently only 'C' for Contra Costa County is used), ppp is the page number with leading zeros, c is the grid column letter ('A' through 'Z'), and r is the grid row digit ('0' through '9'). For example, the map reference for the EMS office at 50 Glacier Drive in Martinez is "C010E6" (Contra Costa County book, page 10, grid square E6). The new style format is pppcr, where pppp is the page number with leading zeros and c and r are as described above. The new format map pages numbers are unique statewide. Map books using the new format will be available at retail establishments in August, 1996. Conversion from the old to the new format within the County is scheduled to be completed by Jan 6, 1997. In the interim, developers are required to handle the old style and if unable to use the new style should at least recognize it (by checking whether the first character is alphabetic or numeric) and then revert to using either the *position* or *county-map-reference* fields, if either is supplied.
position is the variable length latitude and longitude of the location in signed decimal notation with a comma separator: e.g., the location of the EMS office at 50 Glacier Drive in Martinez in this notation is "37.989,-122.086".
county-map-reference is a variable length field containing the County map reference based on the California State Coordinate System, Zone III (see the Sate of California Public Resources Code, Division 8, Chapter 1.) The format is "p e,n", where p is the map page and e and n are the East and North grid line coordinates in thousands of feet. For example, the reference for the EMS office at 50 Glacier Drive in Martinez is "AG13 1543;546" (page G13, 1,543,000 feet East, 546,000 feet North).
additional-location is an optional variable length free format text field containing additional location information.

Several files are available at the Common Data Repository to assist in converting from old to new Thomas Bros. map coordinates. In addition, Thomas Bros. has committed to provide assistance in the conversion on a case-by-case basis.

The *rp-record* format is:

rp-name<FS>*rp-location*<FS>*rp-phone*<FS>*rp-available*

where:

rp-name is an optional variable length field containing the reporting party=s name.
rp-location is an optional variable length field containing the reporting party=s location, typically an address represented as free-form text.
rp-phone is an optional variable length field containing the reporting party=s telephone number, including the area code.
rp-available is an optional fixed length field containing the letter >Y= if the reporting party can be contacted, >N= if not, >U= if unknown (i.e, discretionary). If this field is ommitted then >U= should be assumed.

Type 02 - Service Request Acknowledgment

This is a mandatory message sent in response to receiving a Type 01, Type 05 and Type 06 message and indicates that the service provider has received the request and commenced the process of dispatching the requested unit. No response is expected.

The message format is:

02[*MTN-incident-id*]<FS>[*provider-incident-id*]

where:

02 is the two character message type.
MTN-incident-id identifies which MTN incident this message refers to.
provider-incident-id is the incident id assigned to the unit or to the incident by the service provider. If this field is null then you will eventually obtain provider's incident number when the unit is dispatched.

Type 03 - Incident Update

This discretionary message is used to update information about an incident, and/or provide supplementary information about the incident. No response is expected. The format of the message is identical to a Type 01 message, but most fields and records are null. The most common use is to send supplementary information about an incident. In this case, the message format would be:

03[*MTN-incident-id*]<RS><RS><RS><RS><RS>[*free-text*]

If only the *common-place-name* were being updated the message format would be:

03[*MTN-incident-id*]<RS><RS><RS><RS><FS>[*common-place-name*]<RS>

Note that if *requested-equipment-code, equipment-count*, *response-code,* or *free-text* fields are supplied they are ignored. If you need to change these fields the proper mechanism is a Type 05 message.

In the examples above, redundant <RS> bytes were not removed for the sake of clarity.

Type 04 - Unit Status Change

This is a mandatory message sent by the owner of a unit to the agency that requested the unit. This message is sent whenever the status of the unit changes, including when the unit is initially assigned to an incident. No response is expected.

The message format is:

04[*MTN-incident-id*]<FS>[*provider-incident-id*]<RS>
[*unit-id*]<FS>[*dispatched-equipment-code*]<RS>[*unit-status*]

where:

04 is the two character message type.
MTN-incident-id is the thirteen character MTN incident identifier (see page 5).
unit-owners-incident-id is the optional incident identifier associated with the unit.
unit-id is the unit identifier and is a string up to nine characters long whose format is solely determined by the owner of the unit. Typical unit identifiers might be 61, 061, E41, and 3A12.
dispatched-equipment-code is a required code (see page D-7) indicating the type of equipment specified by the *unit-id* field. Until all current implementations are upgraded to include this field it should be treated as optional by new implementations. The primary use of this information is for statistical analysis and any use for operational purposes is discretionary. Although inclusion of this field on subsequent status changes for the same *unit-id* value during a particular incident is redundant the field should always be included.
unit-status is a required variable length field that contains information about the status of the unit. The format is:

DI Dispatched, no supplemental data
RG Responding, no supplemental data
CO Called off, no supplemental data
OS On-scene, no supplemental data
TR[*response-code*][*passenger-count*][*destination-code*]<FS>[*free-text*]
where:
response-code is a one character code indicating the level of response (see page D-3).
passenger-count is the one character passenger count, '1'..'9'.
destination-code is the six character code indicating the destination (see page D-2), or "000000" if no code is available).
free-text is optional supplementary free-form text information.
AD Arrived at destination
A1 Available 1st (e.g., 10-8 at the hospital)
AA Available all (e.g., on station)

Exchange of units in mid-run is done by sending three Unit Status Change messages: one calling off the first unit, one indicating that the second unit has been dispatched, and one indicating that the second unit is responding. After that, the message progression proceeds the same as if no exchange had taken place. Note that the unit provider's trip response time is not affected any unit exchanges.

Implementors should note that Type 04 messages can arrive out of logical sequence for a variety of reasons, and duplicate status changes can occur. The two most common causes are accidental status button pushes by ambulance crews, and simultaneous entry of status changes by both a dispatcher and a crew.

Implementors are also cautioned against treating a `CO` as the end of an incident. A `CO` signals the end of an incident only if the unit involved a) transported, and b) it is the only or last unit on the call. A `CO` is frequently used in place of `A1` or `AA` after `AD`.

Type 05 - Request For Additional Service

This is a discretionary message sent to an agency to request additional units on an existing incident. The expected response is a Type 02 message.

The message format is:

> `05`[*MTN-incident-id*]`<FS>`[*requestor-incident-id*]`<RS>`
> [*requested-equipment-code*]`<FS>`[*equipment-count*]`<FS>`[*incident-code*]`<FS>`
> [*response-code*]`<RS>`free-text

where:

> `05` is the two character message type.
> The remaining fields are as described for the Type 01 message, *except that the equipment count is the additional number of pieces of equipment being requested for this incident*.
> *free-text* is optional record specifying supplementary information.

Note that this format is a subset of the format used for a Type 01 message; location information is omitted. If location information needs to be updated then a Type 03 message should also be sent.

Type 06 - Incident Notification

This message type is identical to a Type 01 Incident Request message in all respects, except that after the Type 02 Service Request Acknowledgment message is received there is no further traffic regarding the incident. This message type is used to hand off an incident to an agency that is more properly the incident originator. This message type can only be sent by a client to a server. A typical use would be for AMR dispatchers to notify CFD of an incident reported directly to AMR's dispatch center or witnessed by an AMR crew in transit.

Type 10 - Operational Message

This is a discretionary message sent to impart *critical* information that is not associated with a specific incident. No response is expected.

The message format is:

`10`[*free-text*]

where:

`10` is the two character message type.
free-text is the text of the message.

A road closure notice or a warning regarding an impending system shutdown would qualify as operational messages.

Type 20 - Unit Service Status

This is a mandatory message sent by the owner of a unit acting as a server to all active eavesdrop circuits. This message is sent whenever a unit is put into or removed from service. No response is expected. These messages are typically used by backup servers to maintain the current status of all available units in anticipation of a fail-over to the backup server. They are also intended to be used in situations where a unit is dispatchable by two or more servers.

The message format is:

`20`[*unit-id*]`<FS>`[*dispatched-equipment-code*]`<RS>`[*unit-status*]

where:

`20` is the two character message type.
unit-id is a required field up to nine characters long that specifies the unit idenifier. The format is solely determined by the owner of the unit. Typical unit identifiers might be `61`, `061`, `E41`, and `3A12`.
dispatched-equipment-code is a required field (see page D-7) indicating the type of equipment specified by the *unit-id* field.
unit-status is a required field with a one character code that indicates the status of the unit. The format is:

Code	Status
`I`	In service, dispatchable; sent when a unit is in service and is dispatchable.
`U`	In service, unavailable; sent when a unit is in service but cannot be dispatched for reasons unrelated to an incident. Unavailability due to an incident should be tracked by monitoring Type 04 messages on an eavesdrop circuit.
`O`	Out of service

Transitions between I(n service) or U(navailable) and O(ut of service) should generally occur no more than once per shift. Transitions between I(n service) and U(nvailable) can occur as appropriate (up to several times per shift). Servers whose units are considered as always in service should generate one of these messages for each unit at least once per shift and eavesdroppers should use a default unit service status of I(n service) for those units upon startup. If you're unsure what the default unit service status is for an agency's units contact them for guidance.

Type 80 - Informational Message

This is a discretionary message sent to impart *non-critical* information that is not associated with a specific incident. No response is expected.

The message format is:

80[*sender*]<FS>[*receiver*]<FS>[*free-text*]

where:

80 is the two character message type.
sender is the person or location at the originating site: e.g., "Al Nielsen" or "Shift Supervisor".
receiver is the person or location at the receiving site: e.g., "John Smith" or "CAD Supervisor".
free-text is the text of the message.

This message type is intended to be used in lieu of TCP/IP standard mail protocols when one EMS agency wants to simply announce something to another agency. How the message is handled is entirely at the discretion of the CAD system that receives the message. It is not intended that computers at either end will treat the sender and receiver fields as anything other than free text.

Type 90 - Are You There?

This is a discretionary message sent to test whether or not an agency is operational. The expected responses are a) an error from your TCP/IP indicating that the circuit was closed, b) a timeout indicating that the agency's TCP/IP front-end processor is operational, but the back-end CAD system is not, or c) a Type 91 message indicating that all is well.

The message format is:

```
90
```

where:

`90` is the two character message type.

Type 91 - I Am Here

This message is sent in response to receiving a Type 90 message.

The message format is:

```
91
```

where:

`91` is the two character message type.

NOTE: In order to keep 90/91 exchanges used for the purpose of early detection of network or server failures from becoming a significant burden on critical servers, clients should generate a type 90 message only when it has been at least ten minutes since the previous message was sent or received on a client circuit. If any server experiences an aggregate incoming type 90 message rate of more than one per minute then its client agencies will be advised to increase the idle time value.

Type 99 - Protocol Error

This is discretionary message is returned when the receiver of a message detects that the format of the MTN message that it received is incorrect.

The message format is:

99[*error-text*]<RS>[*MTN-message*]

where:

99 is the two character message type.
error-text is an optional text string that indicates the type of error detected (e.g., "Unknown message type code").
MTN-message is the message that contained the error, exactly as it was received.

Type 99 messages will typically occur most often during debugging and are not expected to occur during normal operation.

Message Type Flow Summary

Agencies acting as EMS Clients will send the following message types:

01	Request For Service
03	Incident Update
04	Unit Status Change
05	Request For Additional Service
06	Incident Notification
10	Operational Message
80	Informational Message
90	Are You There?
99	Protocol Error

Agencies acting as EMS Servers will send the following message types:

02	Service Request Acknowledgment
04	Unit Status Change
10	Operational Message
20	Unit Service Status
80	Informational Message
91	I Am Here
99	Protocol Error

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APPENDIX F - INCIDENT MESSAGE TRAFFIC EXAMPLE

Time	From	To	Msg Type	Incident id	Message contents
12:00:00	CFD	AMR	01	CFD272343378	Request type A, incident code MCP3, "EMS Building in Martinez", EMD determinant code 10D02
12:00:01	AMR	CFD	02	CFD272343378	Service request acknowledged
12:00:02	CFD	AMR	04	CFD272343378	Unit E31 dispatched
12:00:10	CFD	AMR	04	CFD272343378	Unit E31 responding
12:00:15	AMR	CFD	04	CFD272343378	Unit 023 dispatched
12:00:30	AMR	CFD	04	CFD272343378	Unit 023 responding
12:02:51	CFD	AMR	03	CFD272343378	Victim in mens lavatory, 3rd floor, East wing
12:05:14	CFD	AMR	04	CFD272343378	Unit E31 on-scene
12:09:12	AMR	CFD	04	CFD272343378	Unit 023 on-scene
12:10:15	CFD	AMR	04	CFD272343378	Unit E31 called off
12:14:41	AMR	CFD	04	CFD272343378	Unit 023 transporting 2 passengers to JMH, code 2
12:20:31	AMR	CFD	04	CFD272343378	Unit 023 at destination
12:22:41	AMR	CFD	04	CFD272343378	Unit 023 available 1st
12:25:01	AMR	CFD	04	CFD272343378	Unit 023 available all

The actual packet traffic for the example might look like this:

```
CFD->AMR  12:00:00  MI01CFD272343378<FS>RIID<RS>t
                    A<FS>1<FS>MCP<FS>3<RS>t
                    50<FS><FS>Glacier<FS>Dr<FS><FS>MTZ<RS>t
                    <FS>Glacier<FS>Dr<FS><FS>MTZ<FS>t
                    <FS>Muir<FS>Rd<FS><FS>MTZ<RS>t
                    <FS>EMS Building<FS>C010E6<FS>37.989,-122.086<FS>t
                    G13 1543,546<FS>At rear<RS>Explosion reported<RS>10D02<EOT>
CFD<-AMR  12:00:01  MI02CFD272343378<FS>4110432<EOT>
CFD->AMR  12:00:02  MI04CFD272343378<FS>4110432<RS>E31<FS>BEN1<RS>DI<EOT>
CFD->AMR  12:00:10  MI04CFD272343378<FS>4110432<RS>E31<FS>BEN1<RS>RG<EOT>
CFD<-AMR  12:00:15  MI04CFD272343378<FS>4110432<RS>023<FS>BEN2<RS>DI<EOT>
CFD<-AMR  12:00:30  MI04CFD272343378<FS>4110432<RS>023<FS>BEN2<RS>RG<EOT>
CFD->AMR  12:02:51  MI03CFD272343378<RS><RS><RS><RS><RS>t
                    Victim in men's lav, 3rd flr, E wing<EOT>
CFD->AMR  12:04:14  MI04CFD272343378<FS>4110432<RS>E31<FS>BEN1<RS>OS<EOT>
CFD<-AMR  12:09:12  MI04CFD272343378<FS>4110432<RS>023<FS>BEN2<RS>OS<EOT>
CFD->AMR  12:10:15  MI04CFD272343378<FS>4110432<RS>E31<FS>BEN1<RS>CO<EOT>
CFD<-AMR  12:14:41  MI04CFD272343378<FS>4110432<RS>023<FS>BEN2<RS>TR22070988<EOT>
CFD<-AMR  12:20:31  MI04CFD272343378<FS>4110432<RS>023<FS>BEN2<RS>AD<EOT>
CFD<-AMR  12:22:41  MI04CFD272343378<FS>4110432<RS>023<FS>BEN2<RS>A1<EOT>
CFD<-AMR  12:25:01  MI04CFD272343378<FS>4110432<RS>023<FS>BEN2<RS>AA<EOT>
```

(**t** indicates a New Line added here just to improve readability)

APPENDIX G - MTN II

This section exists to provide a place to document features that have been identified for consideration in future generations of the MTN. Developers should be aware that inclusion in this section does not guarantee that a feature will ultimately be implemented, but if making allowance for a feature can be done at negligible cost while implementing software to comply with the current specification then it should be done.

CARBON COPIES

The need for a general purpose carbon copy facility has been strongly[1] expressed, but the preliminary design has been withdrawn pending further study of the impact on software complexity and MTN traffic.

The facility currently envisioned involves sending carbon copies of MTN packets to receivers who have expressed an interest in certain types of incidents based on some set of criteria.

Comments on how this facility will actually be used are invited.

[1] Do not be misled by the brevity of this section: carbon copies *will* happen. It's just a matter of figuring out a way to do it that does not involve blanket broadcasting of data to every agency in the County.