               Migrating from X.400(84) to X.400(88)

Status of this Memo

   This memo provides information for the Internet community. This memo
   does not specify an Internet standard of any kind. Distribution of
   this memo is unlimited.

Scope

   In the context of a European pilot for an X.400(88) messaging
   service, this document compares such a service to its X.400(84)
   predecessor. It is aimed at a technical audience with a knowledge of
   electronic mail in general and X.400 protocols in particular.

Abstract

   This document compares X.400(88) to X.400(84) and describes what
   problems can be anticipated in the migration, especially considering
   the migration from the existing X.400(84) infrastructure created by
   the COSINE MHS project to an X.400(88) infrastructure. It not only
   describes the technical complications, but also the effect the
   transition will have on the end users, especially concerning
   interworking between end users of the 84 and the 88 services.

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1. New Functionality

   Apart from the greater maturity of the standard and the fact that it
   makes proper use of the Presentation Layer, the principal features of
   most use to the European R&D world in X.400(88) not contained in
   X.400(84) are:

    - A powerful mechanism for arbitrarily nested Distribution
      Lists including the ability for DL owners to control access
      to their lists and to control the destination of nondelivery
      reports. The current endemic use of DLs in the research
      community makes this a fundamental requirement.

    - The Message Store (MS) and its associated protocol, P7. The
      Message Store provides a server for remote User Agents (UAs)
      on Workstations and PCs enabling messages to be held for
      their recipient, solving the problems of non-continuous
      availability and variability of network addresses of such
      UAs. It provides powerful selection mechanisms allowing the
      user to select messages from the store to be transferred to
      the workstation/PC. This facility is not catered for
      adequately by the P3 protocol of X.400(84) and provides a
      major incentive for transition.

    - Use of X.500 Directories. Support for use of Directory Names
      in MHS will allow a transition from use of O/R Addresses to
      Directory Names when X.500 Directories become widespread,
      thus removing the need for users to know about MHS
      topological addressing components.

    - The provision of message Security services including
      authentication, confidentiality, integrity and non-
      repudiation as well as secure access between MHS components
      may be important for a section of the research community.

    - Redirection of messages, both by the recipient if
      temporarily unable to receive them, and by the originator in
      the event of failure to deliver to the intended recipient.

    - Use of additional message body encodings such as ISO 8613
      ODA (Office Document Architecture) reformattable documents or
      proprietary word processor formats.

   - Physical Delivery services that cater for the delivery of an
     electronic message on a physical medium (such as paper)
     through the normal postal delivery services to a recipient
     who (presumably) does not use electronic mail.

   - The use of different body parts. In addition to the
     extensible externally defined body parts, the most common
     types are predefined in the standard. In order to give end-
     users a real advantage as compared to other technologies, the
     following body-parts should be supported as a minimum:

         - IA5
         - Message
         - G3FAX
         - External
            - General Text
            - Others

     The last bullet should be interpreted as follows: all UAs
     should be configurable to use any type of externally defined
     body part, but as a minimum General Text can be generated and
     read.

   - The use of extended character sets, both in O/R addresses
     and in the General Text extended bodypart. As a minimum, the
     character sets as described in the European profiles will be
     supported. A management domain may choose as an internal
     matter which character sets it wants to support in
     generating, but all user agents must be able to copy (in
     local address books and in replies) any O/R address, even if
     it contains character sets it cannot interpret itself.

2. OSI Supporting Layers

   The development of OSI Upper Layer Architecture since 1984 allows the
   new MHS standards to sit on the complete OSI stack, unlike X.400(84).
   A new definition of the Reliable Transfer Service (RTS), ISO 9066,
   has a mode of operation, Normal-mode, which uses ACSE and the OSI
   Presentation Layer. It also defines another mode compatible with
   X.410(84) RTS that was intended only for interworking with X.400(84)
   systems.

   However, there are differences between the conformance requirements
   of ISO MOTIS and CCITT X.400(88) for mandatory support for the
   complete OSI stack. ISO specify use of Normal-mode RTS as a mandatory
   requirement with X.410-mode RTS as an additional option, whereas
   CCITT require X.410-mode and have Normal-mode optional. The ISO
   standard identifies three MTA types to provide options in RTS modes:

   - MTA Type A supports only Normal-mode RTS, and provides
     interworking within a PRMD and with other PRMDs (conforming
     to ISO 10021), and with ADMDs which have complete
     implementations of X.400(88) or which conform to ISO 10021.

   - MTA Type B adds to the functionality of MTA type A the
     ability to interwork with ADMDs implementing only the minimal
     requirements of X.400(88), by requiring support for X.410-
     mode RTS in addition to Normal-mode.

   - MTA Type C adds to the functionality of MTA type B the
     ability to interwork with external X.400(84) Management
     Domains (MDs, i.e., PRMDs and ADMDs), by requiring support for
     downgrading (see 5.1) to the X.400(84) P1 protocol.

The interworking between ISO and CCITT conformant systems is
summarised in the following table:

                              CCITT

                   X.400(84)   X.400(88)
                                  minimal   complete
                                  implementation

ISO 10021/   MTA Type A   N   N   Y
MOTIS   MTA Type B   N   Y   Y
             MTA Type C   Y   Y   Y

          Table 1: Interworking ISO <-> CCITT systems

The RTS conformance difference would totally prevent interworking
between the two versions of the standard if implementations never
contained more than the minimum requirements for conformance, but in
practice many 88 implementations will be extensions of 84 systems,
and will thus support both modes of RTS. (At the moment we are aware
of only one product that doesn't support Normal mode.)

Both ISO and CCITT standards require P7 (and P3) to be supported
directly over the Remote Operations Service (ROS), ISO 9072, and use
Normal-mode presentation (and not X.410-mode). Both allow optionally
ROS over RTS (in case the Transport Service doesn't provide an
adequately reliable service), again using Normal-mode and not X.410-
mode.

CCITT made both Normal and X.410 mode mandatory in its X.400(92)
version, and it is expected that the 94 version will have the X.410
mode as an option only.

3. General Extension Mechanism

   One of the major assets in ISO 10021/X.400(88) is the extension
   mechanism. This is used to carry most of the extensions defined in
   these standards, but its principal benefit will be in reducing the
   trauma of transitions to future versions of the standards. Provided
   that implementations of the 88 standards do not try to place
   restrictions on the values that may be present, any future extension
   will be relayed by these implementations when appropriate (i.e., when
   the extension is not critical), thus providing a painless migration
   to new versions of the standards.

4. Interworking

4.1. Mixed 84/88 Domains

   ISO 10021-6/X.419(88) defines rules for interworking with X.400(84),
   called downgrading. As X.400 specifies the interconnection of MDs,
   these rules define the actions necessary by an X.400(88) MD to
   communicate with an X.400(84) MD. The interworking rules thus apply
   at domain boundaries. Although it would not be difficult to extend
   these to rules to convert Internal Trace formats which might be
   thought a sufficient addition to allow mixed X.400(84)/X.400(88)
   domains, the problems involved in attempting to define mixed 84/88
   domains are not quite that simple.

   The principle problem is in precisely defining the standard that
   would be used between MTAs within an X.400(84) domain, as X.400(84)
   only defines the interconnection of MDs. In practice, MTA
   implementations either use X.400(84) unmodified, or X.400(84) with
   the addition of Internal Trace from the first MOTIS DIS (DIS 8883),
   or support MOTIS as defined in DIS 8505, DIS 8883, and DIS 9065. The
   second option is recommended in the NBS Implementors Agreements, and
   the third option is in conformance with the CEN/CENELEC MHS
   Functional Standard [1], which requires as a minimum tolerance of all
   "original MOTIS" protocol extensions. An 84 MD must decide which of
   these options it will adopt, and then require all its MTAs to adopt
   (or at least be compatible with) this choice. No doubt this is one of
   the reasons for the almost total absence currently of mixed- vendor
   X.400(84) MDs in the European R&D MHS community. The fact that none
   of these three options for communication between MTAs within a domain
   have any status within the standardisation bodies accounts for the
   absence from ISO 10021/X.400(88) of detailed rules for interworking
   within mixed 84/88 domains.

   Use of the first option, unmodified X.400(84), carries the danger of
   undetectable routing loops occurring. Although these can only occur
   if MTAs have inconsistent routing tables, the absence of standardised

methods of disseminating routing information makes this a possibility
which if it occurred might cause severe disruption before being
detected. The only addition to the interworking rules needed for this
case is the deletion of Internal Trace when downgrading a message.

Use of the second option, X.400(84) plus Internal Trace, allows the
detection and prevention of routing loops. Details of the mapping
between original-MOTIS Internal Trace and the Internal Trace of ISO
10021 can be found in Annex A. This should be applied not only when
downgrading from 88 to 84, but also in reverse when an 84 MPDU is
received by the 84/88 Interworking MTA. If the 84 domain properly
implements routing loop detection algorithms, then this will allow
completely consistent reception of messages by an 84 recipient even
after DL expansion or Redirection within that domain (but see also
section 5.3). Unfortunately, the first DIS MOTIS like X.400(84) left
far too much to inference, so not all implementors may have
understood that routing loop detection algorithms must only consider
that part of the trace after the last redirection flag in the trace
sequence.

Use of the third option, tolerance of all original-MOTIS extensions,
would in principle allow a still higher level of interworking between
the 84 and 88 systems. However, no implementations are known which do
more than relay the syntax of original-MOTIS extensions: there is no
capability to generate these protocol elements or ability to
correctly interpret their semantics.

The choice between the first two options for mixed domains can be
left to individual management domains. It has no impact on other
domains provided the topology recommended in section 5 is adopted.

4.2. Generation of OR-Name Extensions from X.400(84)

The interworking rules defined in DIS 10021-6/X.419 Annex B allow for
delivery of 88 messages to 84 recipients, but do not make any 88
extensions available to 84 originators. In general this is an
adequate strategy. Most 88 extensions provide optional services or
have sensible defaults. The exception to this is the OR-Name
extensions. These fall into three categories: the new CommonName
attribute; fifteen new attributes for addressing physical delivery
recipients; and alternative Teletex (T.61) encodings for all
attributes that were defined as Printable Strings. Without some
mechanism to generate these attributes, 84 originators are unable to
address 88 recipients with OR-Addresses containing these attributes.
Such a mechanism is defined in RARE Technical Report 3 ([2]), "X.400
1988 to 1984 downgrading".

Common-name appears likely to be a widely used attribute because it
remedies a serious deficiency in the X.400(84) OR-Name: it provides
an attribute suitable for naming Distribution Lists and roles, and
even individuals where the constraints of the 84 personal-name
structure are inappropriate or undesirable. As 84 originators will no
doubt wish to be able to address 88 DLs (and roles), [2] defines a
Domain Defined Attribute (DDA) to enable generation of common-name by
84 originators. This consists of a DDA with its type set to "common-
name" and its value containing the Printable String encoding to be
set into the 88 common-name attribute.

This requires that all European R&D MHS 88 MTAs capable of
interworking with 84 systems shall be able to map the value of
"common-name" DDA in OR-Names received from 84 systems to the 88
standard attribute extension component common-name, and vice versa.

X.400(84) originators will only be able to make use of this ability
to address 88 common-name recipients if their system is capable of
generating DDAs. Unfortunately, one of the many serious deficiencies
with the CEN/CENELEC and CEPT 84 MHS Functional Standards ([1] and
[3]), as originally published, is that this ability is not a
requirement for all conformant systems. Thus if existing European R&D
MHS X.400(84) users wish to be able to address a significant part of
the ISO 10021/X.400(84) world they must explicitly ensure that their
84 systems are capable of generating DDAs. However, this will be a
requirement in the revised versions of ENV 41201 and ENV 41202, which
are to be published soon. There is no alternative mechanism for
providing this functionality to 84 users. It is estimated that
currently 95% of all European R&D MHS users are able to generate
DDAs.

When messages are sent to both ISO 10021/X.400(88) and X.400(84)
recipients outside the European R&D MHS community, this
representation of common-name will not enable the external recipients
to communicate directly unless their 84/88 interworking MTA also
implements this mapping. However, use of this mapping within the
European R&D MHS community has not reduced external connectivity, and
provided RTR 3, RFC 1328 is universally implemented within this
community it will enhance connectivity within the community.

As for the new Physical Delivery address attributes in X.400(88), RTR
3 (RFC1328) takes the following approach. A DDA with type "X400-88"
is used, whose value is an std-or encoding of the address as defined
in RARE Technical Report 2 ([4]), "Mapping between X.400(1988)/ISO
10021 and RFC 822". This allows source routing through an appropriate
gateway. Where the generated address is longer than 128 characters,
up to three overflow DDAs are used: X400-C1; X400-C2; X400-C3. This
solution is general, and does not require co-operation, i.e., it can

be implemented in the gateways only.

Note that the two DDA solutions mentioned above have the undesirable
property that the P2 heading will still contain the DDA form, unless
content upgrading is also done. In order to shield the user from
cryptic DDAs, such content upgrading is in general recommended, also
for nested forwarded messages, even though the available standards
and profiles do not dictate this.

4.3. Distribution List Interworking with X.400(84)

Before all X.400(84) systems are upgraded to ISO 10021, the
interaction of Distribution Lists with X.400(84) merits special
attention as DLs are already widely used.

Nothing, apart perhaps from the inability to generate the DL's OR-
Address if the DL uses the common-name attribute, prevents an
X.400(84) originator from submitting a message to a DL.

X.400(84) users can also be members (i.e., recipients) of a DL.
However, if the X.400(84) systems involved correctly implement
routing loop detection, the X.400(84) recipient may not receive all
messages sent to the DL. X.400(84) routing loop detection involves a
recipient MD in scanning previous entries in a message's trace
sequence for an occurrence of its own domain, and if such an entry is
found the message is non-delivered. The new standards extend the
trace information to contain flags to indicate DL-expansion and
redirection, and re-define the routing loop detection algorithm to
only examine trace elements from the last occurrence of either of
these flags. Thus 88 systems allow a message to re-traverse an MD (or
be relayed again by an MTA) after either DL-expansion or redirection.
However, these flags cannot be included in X.400(84) trace, so are
deleted on downgrading. Therefore the 84 DL recipient will receive
all messages sent to the DL except those which had a common point in
the path to the DL expansion point with the path from the expansion
points to his UA. This common point is an MD in the case of a DL in
another MD or an MTA in the case of a DL in the same MD. Although
this is quite deterministic behaviour, the user is unlikely to
understand it and instead regard it as erratic or inconsistent
behaviour.

Another problem with X.400(84) DL members will be that delivery and
non-delivery reports will be sent back directly to the originator of
a message, rather than routed through the hierarchy of DL expansion
points where they could have been routed to the DL administrator
instead of (or as well as) the originator.

No general solution to this problem has yet been devised, despite
much thought from a number of experts. The nub of the problem is that
changing the downgrading rules to enable 84 recipients to receive all
such messages also allows the possibility of undetectable infinite DL
or redirection looping where there is an 84 transit domain.

A potential solution is to extend the DL expansion procedures to
explicitly identify X.400(84) recipients and to treat them specially,
at least by deleting all trace prior to the expansion point. This
solution is only dangerous if another DL reached through an 84
transit domain is inadvertently configured as an 84 recipient, when
infinite looping could occur. It does however impose the problems of
84 interworking into MHS components which need to know nothing even
of the existence of X.400(84). It also requires changes to the
Directory attribute mhs-dl-members to accommodate the indication that
identifies the recipient as an X.400(84) user, unless European R&D
MHS DLs are restricted to being implemented by local tables rather
than making use of the Directory.

A similar change would be required for Redirection. However, the
change for Redirection would have substantially more impact as it
would require European R&D MHS-specific MHS protocol extensions to
identify the redirected recipient as an X.400(84) user. If the
European R&D MHS adopts a reasonable quality of MHS(88) service, all
its MTAs would be capable of Redirection and all UAs would be capable
of requesting originator-specified-alternate-recipient and thus be
required to incorporate these non-standard additions. A special
European R&D MHS modification affecting all MTAs and UAs seems
impractical, too!

If the recommended European R&D MHS topology for MHS migration (See
chapter 5) is adopted there will never be an X.400(84) transit domain
(or MTA) between two ISO 10021 systems. This allows the deletion of
trace prior to the last DL expansion or redirection to be performed
as part of the downgrading, giving the X.400(84) user a consistent
service. This solution has the advantage of only requiring changes at
the convertors between X.400(84) and ISO 10021/X.400(88), where other
European R&D MHS specific extensions have also been identified. A
precise specification of this solution is given in Annex A.

Finally, problems might occur because some X.400(84) MTAs could
object to messages containing more than one recipient with the same
extension-id (called originally-requested-recipient-number in the new
standards), since this was not defined in X.400(84). Note that
X.400(84) only requires that all extension-id's be different at
submission time, so 84 software that does not except messages with
identical extension-id's for relaying or delivery must be considered
broken.

4.4. P2 Interworking

   RTR 3, RFC 1328 also defines the downgrading rules for P2 (IPM)
   interworking: The IPM service in X.400(1984) is usually provided by
   content type 2. In many cases, it will be useful for a gateway to
   downgrade P2 from content type 22 to 2. This will clearly need to be
   made dependent on the destination, as it is quite possible to carry
   content type 22 over P1(1984). The decision to make this downgrade
   will be on the basis of gateway configuration.

   When a gateway downgrades from 22 to 2, the following should be done:

     1. Strip any 1988 specific headings (language indication, and
        partial message indication).

     2. Downgrade all O/R addresses, as described in Section 3.

     3. If a directory name is present, there is no method to
        preserve the semantics within a 1984 O/R Address. However, it
        is possible to pass the information across, so that the
        information in the Distinguished Name can be informally
        displayed to the end user. This is done by appending a text
        representation of the Distinguished Name to the Free Form
        Name enclosed in round brackets. It is recommended that the
        "User Friendly Name" syntax is used to represent the
        Distinguished Name [5]. For example:

            (Steve Hardcastle-Kille, Computer Science,
            University College London, GB)

     4. The issue of body part downgrade is discussed in Section 6.

   Note that a message represented as content type 22 may have
   originated from [6]. The downgrade for this type of message can be
   improved. This is discussed in RTR 2, RFC 1327.

   Note that the newer EWOS/ETSI recommendations specify further rules
   for downgrading, which are not all completely compatible with the
   rules in RTR 3, RFC 1328. This paper does not state which set of
   rules is preferred for the European R&D MHS, it only states that a
   choice will have to be made.

   As the transition topology recommended for the European R&D MHS is to
   never use 84 transit systems between 88 systems, it is possible to
   improve on the P2 originator downgrading and resending scenario. The
   absence of 84 transit systems means that the necessity for a P1
   downgrade implies that the recipient is on an 84 system, and thus
   that it is better to downgrade 88 P2 contents to 84 P2 rather than to

relay it in the knowledge that it will not be delivered.

5. Topology for Migration

   Having decided that a transition from X.400(84) is appropriate, it is
   necessary to consider the degree of planning and co- ordination
   required to preserve interworking during the transition.

   It is assumed as a fundamental tenet that interworking must be
   preserved during the transition. This requires that one or more
   system in the European R&D MHS community must act as a protocol
   converter by implementing the rules for "Interworking with 1984
   Systems" listed in Annex B of ISO 10021-6/X.419.

   When downgrading from ISO 10021/X.400(88) to X.400(84) all extensions
   giving functionality beyond X.400(84) are discarded, or if a critical
   extension is present then downgrading fails and a non-delivery
   results. Thus, although it is possible to construct topologies of
   interconnected MTAs so that two 88 MTAs can only communicate by
   relaying through one or more 84 MTA, to maximise the quality of
   service which can be provided in the European R&D MHS community it is
   proposed that it require that no two European R&D MHS 88 MTAs shall
   need to communicate by relaying through a X.400(84) MTA. Furthermore,
   if this is extended to require that no two European R&D MHS 88 MTAs
   shall ever communicate by relaying through an X.400(84) MTA, then the
   European R&D MHS can provide enhanced interworking functionality to
   its X.400(84) users.

   If mixed vintage 88 and 84 Management Domains (MDs) are created, the
   routing loop detection rules, which specify that a message shall not
   re-enter an MD it has previously traversed, require that downgrading
   is performed within that mixed vintage MD. That MD therefore requires
   at least one MTA capable of downgrading from 88 to 84. It is unlikely
   that every MTA within an MD will be configured to act as an entry-
   point to that MD from other MDs. However, the proposed European R&D
   MHS migration topology requires that as soon as a domain has an 88
   MTA it shall also have an 88 entry point - this may, of course, be
   that same MTA.

   Even for MDs operating all the same MHS vintage internally, providing
   entry-points for both MHS vintages will give considerable advantage
   in maximising the connectivity to other MDs. Initially, it will be
   particularly important for 88 MDs to be able to communicate with 84
   only MDs, but as 88 becomes more widespread eventually the 84 MDs
   will become a minority for which the ability to support 88 will be
   important to maintain connectivity. For most practical MDs providing
   entry-points that implement options in the supporting layers will
   also be important. Support for at least the following is recommended

   at MD entry-points:

    88-P1/Normal-mode RTS/CONS/X.25(84)
    88-P1/Normal-mode RTS/RFC1006/TCP/IP
    84-P1/X.25(80)
    84-P1/RFC1006/TCP/IP

   The above table omits layers where the choice is obvious (e.g.,
   Transport class zero), or where no choice exists (e.g., RTS for 84-
   P1).

   The requirement for no intermediate 84 systems does require that the
   European R&D MHS use direct PRMD to PRMD routing between 88 PRMDs at
   least until such time as all ADMDs will relay the 88 MHS protocols.

   Finally, in order to keep routing co-ordination overhead to a
   minimum, an important requirement for the migration strategy is that
   only one common set of routing procedures is used for both 84 and 88
   systems in the European R&D MHS.

6. Conclusion

   1. The transition from X.400(84) to ISO 10021/X.400(88) is
      worthwhile for the European R&D MHS, to provide:

         - P7 Message Store to support remote UAs.
         - Distribution Lists.
         - Support for Directory Names.
         - Standardised external Body Part types.
         - Redirection.
         - Security.
         - Future extensibility.
         - Physical Delivery.

   2. To minimise the number of transitions the European R&D MHS
      target should be ISO 10021 rather than CCITT X.400(88) -
      i.e., straight to use of the full OSI stack with Normal-mode
      RTS.

   3. To give a useful quality of service, the European R&D MHS
      should not use minimal 88 MTAs which relay the syntax but
      understand none of the semantics of extensions. In
      particular, all European R&D MHS 88 MTAs should generate
      reports containing extensions copied from the subject message
      and route reports through the DL expansion hierarchy where
      appropriate.

   4. The European R&D MHS should carefully plan the transition so
      that it is never necessary to relay through an 84 system to
      provide connectivity between any two 88 systems.

   5. The European R&D MHS should consider the additional
      functionality that can be provided to X.400(84) users by
      adopting an enhanced specification of the interworking rules
      between X.400(84) and ISO 10021/X.400(88), and weigh this
      against the cost of building and maintaining its own
      convertors. The advantages to X.400(84) users are:

         - Ability to generate 88 common-name attribute, likely to
           be widely used for naming DLs.
         - Consistent reception of DL-expanded and Redirected
           messages.
         - Ability to receive extended 88 P2 contents
           automatically downgraded to 84 P2.

7. Security Considerations

   Security issues are not discussed in this memo.

Appendix A - DL-expanded and Redirected Messages in X.400(84)

   This Annex provides an additional to the rules for "Interworking with
   1984 Systems" contained in Annex B of ISO 10021-6/X.419, to give
   X.400(84) recipients consistent reception of messages that have been
   expanded by a DL or redirected. It is applicable only if the
   transition topology for the European R&D MHS recommended in section
   3 is adopted.

   Replace the first paragraph of B.2.3 by:

   If an other-actions element is present in any trace- information-
   elements, that other-actions element and all preceding trace-
   information-elements shall be deleted. If an other-actions element is
   present in any subject-intermediate-trace-information- elements, that
   other-actions element shall be deleted.

Appendix B - Bibliography

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Appendix C - MHS Terminology

   Message Handling is performed by four types of functional entity:
   User Agents (UAs) which enable the user to compose, send, receive,
   read and otherwise process messages; Message Transfer Agents (MTAs)
   which provide store-and-forward relaying services; Message Stores
   (MSs) which act on behalf of UAs located remotely from their
   associated MTA (e.g., UAs on PCs or workstations); and Access Units
   (AUs) which interface MHS to other communications media (e.g., Telex,
   Teletex, Fax, Postal Services). Each UA (and MS, and AU) is served by
   a single MTA, which provides that user's interface into the Message
   Transfer Service (MTS).

   Collections of MTAs (and their associated UAs, MSs and AUs) which are
   operated by or under the aegis of a single management authority are
   termed a Management Domain (MD). Two types of MD are defined: an
   ADMD, which provides a global public message relaying service
   directly or indirectly to all other ADMDs; and a PRMD operated by a
   private concern to serve its own users.

   A Message is comprised of an envelope and its contents. Apart from
   the MTS content-conversion service, the content is not examined or
   modified by the MTS which uses the envelope alone to provide the
   information required to convey the message to its destination.

   The MTS is the store-and-forward message relay service provided by
   the set of all MTAs. MTAs communicate with each other using the P1
   Message Transfer protocol.

Appendix D - Abbreviations

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ACSE      Association Control Service Element
ADMD      Administration Management Domain
ASCII     American Standard Code for Information Exchange
ASN.1     Abstract Syntax Notation One
AU        Access Unit
CCITT     Comite Consultatif International de Telegraphique et
          Telephonique
CEN       Comite Europeen de Normalisation
CENELEC   Comite Europeen de Normalisation Electrotechnique
CEPT      Conference Europeene des Postes et Telecommunications
CONS      Connection Oriented Network Service
COSINE    Co-operation for OSI networking in Europe
DL        Distribution List
DIS       Draft International Standard
EN        European Norm
ENV       Draft EN, European functional standard
IEC       International Electrotechnical Commission
IPM       Inter-Personal Message
IPMS      Inter-Personal Messaging Service
IPN       Inter-Personal Notification
ISO       International Organisation for Standardisation
JNT       Joint Network Team (UK)
JTC       Joint Technical Committee (ISO/IEC)
MD        Management Domain (either an ADMD or a PRMD)
MHS       Message Handling System
MOTIS     Message-Oriented Text Interchange Systems
MTA       Message Transfer Agent
MTL       Message Transfer Layer
MTS       Message Transfer System
NBS       National Bureau of Standardization
OSI       Open Systems Interconnection
PRMD      Private Management Domain
RARE      Reseaux Associes pour la Recherche Europeenne
RFC       Request for Comments
RTR       RARE Technical Report
RTS       Reliable Transfer Service
WG-MSG    RARE Working Group on Mail and Messaging
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