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Functional requirements for computer conferencing and computer mediated communications

Computerized Conferencing & Communications Center

Murray Turoff
New Jersey Institute of Technology, murray.turoff@gmail.com

Starr Roxanne Hiltz
New Jersey Institute of Technology, roxanne.hiltz@gmail.com

James Whitescarver

John Foster

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for
COMPUTER CONFERENCING
and
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by

Murray Turoff, Starr Roxanne Hiltz
James Whitescarver, and John Foster

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New Jersey Institute of Technology
Newark, N.J. 07102
(201) 596-EIES

ABSTRACT

This paper is a compilation of the desirable functionality for Computerized Conferencing Systems. It is based upon the research and evaluation activities of the Conferencing Center at NJIT and can be considered as an overall set of objectives for the development of its Conferencing Systems.

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REQUIREMENTS FOR COMPUTERIZED CONFERENCING SYSTEMS

1. Introduction

1.1 Scope

This set of requirements defines the facilities that constitute a Computerized Conferencing System as a general purpose Computer Mediated Communication System. These specifications are based upon the development, utilization, and evaluation work that has taken place since the implementation of the first system of this type in 1971.

Both the necessary functions for constituting a CC system and the desirable facilities for improving the range of applications that a CC system can accommodate will be discussed.

The functionality will be specified utilizing the following types of entities:

- The OBJECTS that comprise a CMC system;
- The MODIFIERS that designate specific subsets of objects having common characteristics;
- The GENERIC ACTIONS, whose functionality may be dependent upon the particular object they are being applied to, the state or status of the object, and the state or status of the member utilizing the command;
- SPECIFIC ACTIONS, which are independent of state or status changes.

1.2 Background

Computerized Conferencing Systems are an example of a the class of systems characterized by the term "Computer Mediated Communication Systems (CMCS)." Electronic mail and/or message systems are examples of other systems falling under this general specification.

Other related terms for specialized or highly tailored instances of this technology are: Groupware, Coordination Systems, Group Decision Support Systems, Electronic Meeting Systems, Bulletin Board Systems, Collaborative Systems, and/or Human Networking.

These requirements result from the work of the Computerized Conferencing and Communications Center, since 1974, in the processes of designing, implementing, prototyping and evaluating Computer Mediated Communication Systems. They also represent, in part, design objectives for the Center's current development efforts.

1.3 General Service Characteristics

Computerized Conferencing Systems are computer based systems designed to facilitate group communications. They are intended to serve the same objectives as face-to-face meetings and video conferencing. However, they may be used in an asynchronous manner, with the computer maintaining a transcript of the information contributed by the group, the status of each group member (what they have and have not seen), and the organization of the material according to the structure of the group process. Computerized Conferencing systems deal with the forms of information that may be created by individuals and stored within a computer. Normally this includes text and graphics; however, it can also include other forms such as digitized voice.

Computerized Conferencing Systems can, in principle, be utilized 24 hours a day by any member of a group from any location in the world through digital data networks or direct phone connections. CMC Systems may also be supported by Local Area Networks. It is assumed that the user has an appropriate terminal, workstation, or personal computer as the primary interface device for creating and sending contributions, as well as for obtaining and displaying the other contributions of the group.

Computerized Conferencing Systems may also be used to support synchronous group meetings, either from remote sites or in a computer supported conference room. Individuals should be able to utilize a system for meeting support in either a synchronous or asynchronous mode. They should not have to learn different systems and have to transfer material between them.

1.4 Objectives

The global objective of a CMC system is the use of computers to facilitate human communications. The objective of CC systems is to facilitate group communications. Associated with this view is the concept that the computer can be used to tailor the process around the nature of the application and the nature of the group.

The ability to obtain these objectives is complicated by a number of design tradeoffs involving parameters such as the size of the group and the relative degree of individual freedom of action versus group objectives. The identification of various tradeoffs in design and their influence on applications has led to a number of specific objectives for these systems.

The specific objectives of CMC systems can be characterized as follows:

1.4.1 Self Tailoring of Communication Structures

The ability to tailor the communication structure is provided to the members of a group who are responsible for the leadership and facilitation of the group activity. Many existing CC systems only provide one particular structure. The ultimate objective is to provide tailoring capability to all the members of the system who wish to establish a conference.

Another aspect of self tailoring is the ability of individuals, acting as receivers, to tailor the form, order, and amount of material they receive. This latter objective leads to compromises between promoting group oriented exchanges and individual preferences for communications.

1.4.2 Organization of Communications

A single communication item is usually a piece of a larger task with which an individual or group is involved. This task is usually characterized by a sequence or collection of communication items. A CMC system must allow members and groups to organize the material in the system in a way that corresponds to the task with which the users are dealing. The same material may need to be organized differently by each individual and/or by each task. As a result, this organization may differ by task, by individual, and by groups.

1.4.3 Support of Human Roles

CMC systems need to provide software support for the human roles necessary to provide structure, facilitation, and leadership for the group activity. These roles can be quite varied with respect to special facilities and their associated privileges.

1.4.4 Reduction of Information Overload

The occurrence of information overload for individuals, with increasing use of this technology by larger groups, is a chronic phenomena. As a result, features designed specifically to minimize this problem are extremely desirable. The potential volume of material any individual has to deal with increases in proportion to the size of the group.

1.4.5 Tracking of Communications

The ability to track whether or not other members of the group are up to date on a discussion and whether various communication tasks have been completed is key to providing a group atmosphere. The system must compensate for the lack of non-verbal and physical cues that exist in traditional media. It must provide the same types of communication signals a group makes use of in face-to-face meetings.

1.4.6 Synchronization of Group Activities

There are many capabilities (e.g. voting, collaborative editing) where the results of the activities of individuals must be brought into synchronization, for the group as a whole. Individuals in leadership roles must be able to regulate the group process, such as opening and closing specific agenda items, votes, compilations of material, etc.

One of the primary advantages of CMC is that individuals can work as independent problem solvers and approach complex tasks in their own preferred sequence. The role of the computer is to provide the structure that brings about a resulting group perspective.

1.4.7 Integration with Other Computer Resources

Many group activities need to make use of existing databases, analysis aids, and models that are contained within a network or host computer. Members of a group need to be able to obtain these materials to add to the conference discussion. The same interface used to communicate with other human beings should be used to communicate with various computer resources. Mechanisms need to be provided that allow integration of such facilities directly in the CMC interface.

1.4.8 Asynchronous and Synchronous Support

A CMC system should be usable in a synchronous mode as well as an asynchronous mode. There are instances when it is critical for a group to get together at the same time and reach a final determination in a timely manner on some issue of concern. The same tools they use asynchronously and the same material they developed in the asynchronous mode need to be available to the group for synchronous meetings.

1.5 Supporting Environment

A particular CMC system might exist as a centralized data base or as a distributed database functioning through virtual machines or user and group agents. Whatever the underlying implementation, there are certain driving requirements:

1.5.1 Master Copies

There should exist only one master copy of an object so that changes to it by different individuals can be identified and regulated. For example, someone who wishes to modify an object while another has already started the process should be notified that a modification is underway and be prevented from proceeding. As a matter of practicality, this usually requires that a complete single conference or group exist as a total master object within a single data store.

1.5.2 Regulation

The emphasis on human roles to regulate specific activities means that their actions have to be conveyed almost immediately to all the members affected. This is particularly obvious in synchronous use situations. Another example is that someone should not be allowed to vote after the vote has been closed. These type of facilities can be supported in a distributed environment only with very high capacity links.

Traditionally, regulation has also meant the necessity to time stamp everything created or modified in a CMC system.

1.5.3 Interconnect

CMC systems do need to interface to networks and to message systems. As a result, they have to be compatible with existing and future

standards in this area.

1.5.4 Object Model

A CMC system lends itself very naturally to an "object" model where members and groups are objects in the system in addition to the standard communication objects (messages, conferences, and comments). This makes it possible to associate micro level privileges with the links between member and group objects and the actual items or collections of communication items. For example, an interface and facility written in other languages can be done independent of concerns about privacy and access rights. The object oriented approach also aids in separating the interface implementation from the internals of the system.

1.5.5 Evolution and Tailorability

It is expected that this technology will continue to evolve in general and in the specifics of the implementation within a given organization. As a result one of the underlying requirements is to create the interface in such a manner that it may be easily changed and evolved over time. For example, differing approaches that have been used recently for meeting this requirement are use of SGML and Smalltalk as interface design languages.

1.5.6 Privacy and Security

It is an absolute necessity that individuals in a CMC system be provided adequate privacy of communications on both an individual and group basis. It is also desirable that the proper facilities be provided to encourage honest use of communications. For example, facilities that allow a receiver to copy messages and comments should also notify the original author that a copy or a resending of an item has occurred.

Actions by one individual should not destroy material created by others. For example, if a person has created a document but utilized material contributed by others, the deletion of the document should not destroy the contributed material.

2. General Terms and Concepts Glossary

The following terms are explained in more detail later in this report. However, an introductory explanation is presented for those terms that are used throughout this document.

2.1 Objects

It is quite natural to view a CMC system using the metaphor of "objects". A CMC system is, in fact, a set of object types which have relationships and linkages to one another within a database structure. The following are the principal objects that comprise a CMC system.

2.1.1 Members

A Computer-Mediated Communication system is made up of "members" who have access to the system and who have certain privileges associated with the creation of entities that can exist in the system. Various objects within the system, such as conferences and groups, may have restricted subsets of members.

2.1.2 Groups

A group is a collection of members dedicated to a particular goal or task. One may send a message to a group label as opposed to having to address each member. There may be conferences associated with the group. The primary objective of a group is to organize activities at the level of a collection of members, and to allow the distinction between messaging and conferencing to function at the group level.

2.1.3 Messages

Most CMC systems have an integral message subsystem which allows the addressing of messages to individual members or to groups such as the membership of a conference. This allows groups to distinguish between transitory material that should be handled via messages and more permanent material that should be accumulated within the database structure of a conference.

2.1.4 Notifications

CMC systems should generate notices of events to their members. For instance, when someone has been made a member of a conference, the system will send an automatic notification of this action. The notification process can be used to provide key communication signaling and an ability to track transactions of importance to the user.

2.1.5 Activities

There must be some mechanism in a CMC system which can trigger special purpose computer programs that support a particular type of

application. We refer to this as an "activity." This facility can also provide a tool for integration between other computer resources and the CMC system. Specific activities are objects that can be linked to an individual conference comment or a message.

2.1.6 Directory

The directory in a given CMC system lists all the members of the system and provides information, such as their address. It also provides a way to search for the system identity (ID) of members by attributes such as name parts, e.g., all the "Roberts."

A directory also should provide facilities that allow individuals to form groups having common interests and concerns. It should also contain various degrees of information on conferences. The amount of information about a conference available in the directory will be the choice of the owner of the conference.

2.1.7 Conferences

The conference is a working database for the collection of the material contributed by a group. Irrespective of the internal structure of the system, the members of the group must be able to view this as a single coherent database of their material.

2.1.8 Membership list

A conference or group has a membership list that may be viewed by any member of the conference and which provides various status reports on the users and their current activity and responsibilities within a group or conference.

2.1.9 Comments and Replies

Comments are the text items which comprise the transcript of a discussion making up a conference. Specific comments that are a response to an earlier comment are called "replies."

2.1.10 Indexes

A CMC system will usually have a number of different indexes. Each conference, group, and member may have an index of keys associated with it. These words or phrases are used to search for entries as well as to reorganize communications to into collections useful on an individual or group basis. Keys may be assigned by the author of an original comment or message and/or by members having a special role to maintain the consistency of the index.

2.2 Modifiers and Attributes

Modifiers serve the purpose of specifying a unique subset of objects. Attributes modify an individual object.

2.2.1 Privileges

A given privilege is an attribute that exists for an internal linkage

between a member or membership list and a given object. It provides the member a particular type of ability with respect to the object (e.g., being able to see it or modify it).

2.2.2 Roles

Members within a conference or group may have a collection of special privileges that give them specific roles. For example, the "owner" of the conference or group has the privilege of adding other users and assigning roles.

2.2.3 New or Waiting items

Typically, the system maintains markers for what a user has seen or has not seen with respect to conference comments and/or associated mail. By individual user, the term "new" often refers to those items (e.g. comments, messages, notifications, etc.) which the user has not yet viewed.

2.2.4 Private

A private conference or group is one that is owned by an individual and for which access by other members is determined by the owner.

2.2.5 Public

A public conference or group is one that may be joined by any member of the CMC system.

2.2.6 Identifiers, Labels, and Names

Objects may have identifiers in terms of unique numbers, names for members, and labels for conferences and groups.

2.2.7 Date-Time stamps

An attribute of any object is the date and time it was created or last modified.

2.2.8 Titles and Keys

Most objects have a title and specific keys to link them to appropriate indexes.

2.2.9 Structure

When the "owner" of a conference or group establishes the object, there are many possible alternatives to "structure" the group or conference. These choices are often a function of the particular objective of the conference or group. For example, those conferences used for free form discussion would allow every member to write a new comment anywhere in the conference. A conference dedicated to generating a collaborative report might restrict authorship by each individual member to certain parts of the conference.

2.3 Generic Commands

These commands provide the overall functionality that is needed to act on a given object. The specific nature of what occurs depends on the specific object and the interaction state the member is in when he or she triggers the command. For each generic command there can be a subset of specific commands that have a unique interpretation and are available to experienced users who wish to make very specific choices in controlling their interaction.

2.3.1 View

The process of viewing the content or partial content of an object.

2.3.2 Review

The process of viewing the status of an object or of a collection of objects.

2.3.3 Find

The process of finding a set of objects by one or more specific attributes.

2.3.4 Create

The process of composing or adding an object.

2.3.5 Modify

The process of changing or editing an object.

2.3.6 Do

The process of executing an activity associated with or linked to an object. This may include such things as voting or joining a conference.

2.3.7 Organize

The process of organizing a collection of objects such as indexing it. Other types of organizing actions include copying or moving an item.

3. DIRECTORY

The goal of a system directory is to serve functions analogous to a telephone book and associated yellow pages. It provides a facility for searching through members and groups in alternative ways and for providing information about the members, groups, and conferences that have been established in the system. Another key function of a system directory in the context of group activities is to provide information about various roles, responsibilities, and objectives of individual members and groups. This information is easy to organize and automate for presentation. Providing a system directory reduces significantly the amount of communication traffic associated with information exchange.

One of the long term advantages of a system directory becomes apparent when there is a large population of users who have common interests. This is over and above the missions of the individual groups which represent the initial teams established on the system. The directory is a principal mechanism whereby individuals with similar interests can find one another and/or locate public conferences or groups that they might be interested in joining.

3.1 Objectives

3.1.1 Alternative Communication Channels

Provide information that allows phone calls and mail to be facilitated when needed.

3.1.2 Getting to Know Members

Provide information on individual members of a group that will help users to get acquainted when they have not had prior face-to-face contact. For example, most users include their job title in their directory description.

3.1.3 Interests Matching

Facilitate the exchange of information among members who have similar interests and concerns.

3.1.4 Identification

Allow members to check the identification of other members and their associated activities in the system, as an aid to memory.

3.1.5 Roles and Responsibilities

Provide the data on roles people have and the responsibilities associated with those roles.

3.1.6 Electronic Migration

Allow for the movement of members into and out of groups and conferences that match their current concerns.

3.1.7 Other Systems and Contacts

Provide information on other systems, networks, and computer based resources that might be of use to the population of users on the system. Also provide the ability to store network address information on other human contacts that are relevant to the user population on the system.

3.2 Structure

3.2.1 Members

The directory contains the following information on members.

3.2.1.1 Identification

Identification is provided by a unique number, a unique nickname, or a unique full name.

3.2.1.2 Descriptive Information

Directories provide a text statement, created by a member, describing their background and interests relevant to the objective for their membership in the system.

Most directories allow members to specify mailing addresses and phone numbers.

3.2.1.3 Interests

This is a facility for the dynamic ability of individuals to self-form groups of common interest. Each member may designate "interest keys" and these may be searched as a special index for the directory. This allows any member to look for any other members with similar interests. An interest key may also be used as a message address and the system will forward such a message to all members who have associated themselves with the given "interest" key. Members may remove themselves from association with a given interest key at any time.

3.2.1.4 Private Information

This is information visible only to the member. The member's access code and pen name are typical. Also, some systems provide a breakdown for the member of their activity in terms of hours of time in the system, number of comments or messages read or created, etc.

3.2.1.5 Roles and Responsibilities

The directory provides a list of the conferences and groups a member owns and/or has other roles in.

3.2.1.6 Status

The directory provides information on the status of the member such as when their account was established, when he or she was last active, and when they expect to be next on the system if, for some reason, they are going to be off line for an extended period of time. If a person is addressing a message to a person who has indicated they will be away from the system until some given date, that information should be displayed during the message addressing procedure.

3.2.2 Groups

A group is a "super-member" comprised of a collection of members. The directory provides the following information on groups.

3.2.2.1 Identification

The group is identified by a unique number and a unique label which corresponds to the ID number and nickname for members. The group also has a title which is analogous to the full name for members.

Members of the group may use this ID to address mail to the rest of the group members. If a non-group member uses the ID, the resulting mail is sent only to the owner of the group.

Identifications of groups may also be used to provide all members of a group the right to join a conference by entering the group id as a member in the conference.

3.2.2.2 Descriptive Information

The directory provides a textual description of the objectives of the group. It also provides a list of all the members with their specific roles and a list of all the conferences that were set up as group conferences.

3.2.2.3 Topics

Topics are a set of keys which are used to describe the subjects of concern to the group or to a given conference. Topics also represent a searchable index within the directory. A message sent to a topic is delivered only to the owner of a group or conference associated with that topic.

3.2.2.4 Membership List

A list of all the members of the group and their associated roles.

3.2.2.5 Status

Information on the status of all the members and conferences that belong to this group. This includes items such as the last time they received an item of group mail or were active in a group conference.

3.2.3 Conferences

A conference is a discussion space oriented to carrying out the communications among a given group of members belonging to the conference.

3.2.3.1 Identification

The identification of a conference is either a number or a label, which are unique within the context of all conferences.

3.2.3.2 Descriptive Information

The owner of a conference may enter a description of that conference in the directory.

3.2.3.3 Topics

The conference may be associated with various topic keys in the topic index.

3.2.3.4 Status

The status information provided is the date the conference was established, the ownership of the conference, a summary of basic parameters, containing data such as, the number of members, the number of comments, and the last date an item was entered.

3.2.3.5 Activity Levels

The directory should provide some information on the activity level of contributions to the conference. This might include the number of members, number of writers, average number of comments written in the last week, etc. The number of writers is the number of individuals who have actually written comments in the conference.

3.3 Searching the directory

One should be able to qualify all searches by limiting them to the membership of indicated groups or indicated conferences. In addition, all searches should have a nested quality. Upon completion of a given search the member should have the option of searching only the list of found items or searching the original population and having the results added to the prior found list.

The types of search facilities that should be provided by a system directory are as follows:

3.3.1 Word Searches

The member should be able to search the interests and topic keys, titles, and/or descriptions stored in the directory.

3.3.2 Names/Labels

The member should be able to search for sub-string matches on parts of names or labels used to identify members, groups, and conferences.

3.3.3 Date/Time

The member should be able to search by the various dates maintained to indicate creation, modification, and activity of members, groups, and conferences.

3.3.4 Location

The members should be able to search by both telephone area codes and zip codes.

3.4 Privacy Considerations

It is up to the member, or owner of a conference or group to decide whether or not to fill in any of the details in the directory beyond the information automatically entered by the system.

For private conferences and groups (non-public) it is also a selection choice to make descriptions viewable by all the members of the system. If these are not declared public than they are restricted to only the members of the group or conference.

The membership list of a group may also be declared private and only viewable by group members.

3.5 Other Considerations

The directory should contain all the information that individual members would like to review or find under various circumstances. For example, not having received an expected communication from another member often leads to checking when the person was last active on the system. In the context of the organization, one could consider a special status signal to indicate if a person is so involved in some task that they are unlikely to be responsive or actively participate in the system. This replicates the type of signals that would be relayed from other members of the group when they are located in the same physical office space which one wishes to try to replace with information in the system directory.

3.6 Notifications

Transactions in the directory should generate the following types of notifications.

3.6.1 Establishments

A new membership in a group should trigger a notification to the owner if it was established by another member having that privileged role. The owner may also select that notifications of new members in a group be sent to all the members of the group.

A member adding themselves to a public conference or a group should generate a notification to the owner.

A new public conference or group should generate a notification to all members of the system.

3.6.2 Deletions

The deletion of a conference or group should generate a notification to all members of that object.

The removal of a member from a conference or group should generate a notification to the member and to the owner if it was not triggered by the owner.

A member removing himself or herself from a group or conference should generate a notification to the owner.

4. Members, Groups and Membership Lists

In order to facilitate the ability of a group to work as a team in an asynchronous manner, a Computer Mediated Communications System must enable individuals to remain informed about the activities, responsibilities, and status of their fellow team members. This observation provides a number of general objectives that underlie specific design requirements.

4.1 Objectives

4.1.1 Signaling

Members of the group need to obtain communication signals about the status of their group, similar to those they would have in a face-to-face environment.

4.1.2 Tasking

Members of the group must be able to easily determine the group tasks and who is working on them.

4.1.3 Status

Members of the group must be able to identify what has been accomplished on the overall group activity and what remains to be done. Communication signals and status information on relative activity of members in a team enhance motivation and equal participation of the group members.

4.1.4 Social-Emotional

Non-verbal communication cues in a face-to-face environment, expressing such things as agreement and disagreement, must be replaced by computer-based facilities. The types of social-emotional communication content that build group cohesion and aid in consensus must be available to the group.

4.2 Members

Members are the users of the systems. On a system wide basis, there are different membership roles possible.

4.2.1 Member Types

The following are the types of members that can exist on a system wide basis.

4.2.1.1 Regular member

Regular members may send and receive mail and notifications. They may also establish conferences, which they will own. They may be made members of the groups and conferences owned by others.

4.2.1.2 Administrative Member

An administrative member has the power to establish other members and groups.

4.2.1.3 Limited Member

A limited member may send and receive mail but not establish conferences.

4.2.1.4 Observer

An observer may read items available to him or her but cannot write anything.

4.2.1.5 Consultants

A consultant has the role of providing help to other users. They are supported in the system by facilities that allow messages and notifications to a single "help" id and are forward to any consultant in a position to accept waiting help requests.

4.2.1.6 System Administrator

This is the role that has the power to establish any of the above members and associated privileges.

4.2.2 Member Files

An individual member has a personal file store which comprises the following facilities

4.2.2.1 Index

A personal index of key terms. This index has the following types of keys:

4.2.2.1.1 Reference Keys

These are keys to which any object on the system may be linked by the member to form a list of items associated with the particular key.

4.2.2.1.2 Category or Filter keys

These are keys which are used by the members to form special filters to search for material.

4.2.2.1.3 Substitution Keys

These are keys that, when used, substitute a stored string. These are practical for developing personal commands and/or storing such things as long network addresses under easy to remember labels.

4.2.2.2 Marked List

The marked list is a special list which the member adds to by use of a "mark" command that can be applied to any object at any time on the system. Certain actions like "replying" to a marked message automatically remove the item from the marked list.

4.2.2.3 Authored List

This is a list of all the items that the member has authored.

4.2.2.4 Notifications

A file of the notifications that the member has received. It is a rotating file in that the newest one pushes out the oldest one. The size of this file is a parameter that can be set by the member.

4.2.2.5 Membership, Roles, Tickets

The member has a list of all conferences and groups that he or she has membership in, with information such as their particular role. In addition, special capabilities such as the tickets given and received are available in the member's personal file.

4.2.2.6 Filter Facilities

A member needs to be able to apply various filters and to be able to track and modify the filter specifications that have been set up. A member should be able to apply filters to searches of conferences or message lists.

In a conference or for messages, members should be able to designate that they do not wish to receive further replies to a given root item. They should also be able to inhibit delivery of items that contain certain keys. The normal process to carry this out should be the automatic routing of these inhibited items to the accepted list, bypassing the new items list. This means an item could be searched for at a later time if the need arose.

There are situations where it is desirable that a member can inhibit reception of messages or conference comments written by designated individuals.

4.2.2.7 Pen-names and Anonymity

Members need to have the ability to have one or more pen-names that they may use to sign messages or comments when they do not wish to be identified. This does have an advantage of allowing a person to have a persona that has continuity over time. This capability has many uses in such applications as education, gaming, policy analysis, conflict resolution, and Delphi exercises. It is also useful to be able to sign messages or comments anonymously.

4.3 Groups

Formal groups are "super members" made up a list of individual members. They are a useful mechanism for both identifying a group and for allowing the group to share various resources.

4.3.1 Group Members

The group is made up of a collection of members who have various roles in the group and who may share various resources available to the group. Members of the system may belong to more than one group.

4.3.2 Group Mail

Group mail is a collection or list of messages that have been addressed to the group identification or label. It is sent to every member of the group and may be searched by any member.

4.3.3 Group Conferences

These are conferences that have been established by the owner of the group and are associated with the group. They may be designated as open to any member of the group or they may be set up as private or public. The group owner may designate another member to act as owner of a given group conference.

4.3.4 Shared Index

Each group has its own shared index of reference and command keys. Any member who links an item to the group index is providing other members of the group the ability to also access the item through the index. That means that group members in different conferences can gather together material of interest to the specific group through the use of this shared index.

4.4 Membership Lists

One of the key elements in accomplishing the above is the three distinct types of membership lists that are possible in a CMC environment. A description of each of these and the data they should provide is below.

For private groups and conferences, only the owner may add and remove members, unless he passes this role to others. However, someone who is already a member can "unjoin" or remove their own membership. If an object is public, any system member can join the associated membership list.

An object containing a membership list, such as a group or conference can be made a member of another membership list. When this is done anyone in the original membership list can join the new membership list.

4.4.1 Conference Membership List

The conference is the primary workspace for a specific group task and the objective of a membership list is to provide the status and activity levels of each member of the group. The data that this list should provide are as follows.

4.4.1.1 Dates

The date a person became a member of the conference. The date a person was last active in the particular conference.

4.4.1.2 Markers and Activity

The last "root" comment in a conference a person has read is indicated by the conference marker. The number of specialized activities they have "done" and/or the number they have left "undone," and the number of comments that they have written.

4.4.1.3 Roles

Any specialized "roles" that the member has in the conference.

4.4.2 Group Membership List

The group is the object that collects all the members and the individual conferences that they, or the group, have set up to accomplish their mission. The data that the group membership list should provide is:

4.4.2.1 Dates

The date a person became a member of the group. The date that they were last active in the group.

4.4.2.2 Markers and Activities

The identification of the last group message a person received. The number of group messages they have written.

4.4.2.3 Roles

Any specialized group "roles."

4.4.3 Activity Membership List

Some forms of "activities" which are attached to a message or comment require their own membership list. The exact data which must be tracked by this type of membership list depends upon the nature of the particular type of activity. The membership list of an activity conveys to the other group members the status of each member, with respect to what activity actions they have or have not "done". An example of activities that need membership lists would be the whole class of voting activities where a vote is sought from the members of a team and it is possible to change one's vote as the discussion continues.

5. Roles, Privileges, and Tickets

Roles are composed of individual privileges defined at a lower level in the CMC system. Tickets are the mechanism for passing individual privileges from one member to another. They provide the ability to handle special cases not covered by the basic role structure.

5.1 Roles

The ability for groups to function depends upon the leadership and facilitation supplied by various members of a group. Certain individuals must take responsibility for organizing the work to be done and facilitating the completion of the respective tasks. There are many cases when individuals must take the responsibility for resolving disputes and keeping the discussion on the right track.

Most CMC systems do provide software to support facilitation and leadership activities. This is software that provides capabilities only to designated individuals in the group, not to all members. Within the context of a CMC system it is also easier to divide certain key responsibilities among a number of different individuals.

The following are the key roles that a CMC system should provide to support a wide range differing collaborative activities.

5.1.1 Owner

The person who establishes a group or conference and who also has the power to carry out any of the other roles mentioned below. The owner, however, is the only one who may initially add or remove members of a conference, assign other roles, or ultimately delete the conference from the system. Ownership may be passed by the owner to another member.

5.1.2 Monitor

The monitor can take over the function of adding or removing members to a group or conference. A monitor can also establish a subset of the roles in this list for any member they add to the conference. That subset is determined by the owner.

5.1.3 Editor

The person who has the power to modify any comment in a conference or any group message. In conferences which have been structured to collaboratively draft a document this role might be restricted to parts of the conference corresponding to the document outline that has been imposed upon the conference structure.

5.1.4 Appender

An appender may add to a comment or link another object to the comment, but not change existing text. Appenders might add or link

items such as marginal notes, appended notifications, and/or attachments. This allows members to make suggestions but prevents them from changing any of the current material.

5.1.5 Indexer

This person has the ability to tailor the conference or group index and to restrict the use of index keys to an approved set. The indexer may also modify the keys on any comment or group message.

5.1.6 Administrator

This person can create "activities." An example of an activity which facilitates the group process is the call for a vote to see the amount of agreement on some issue facing the group.

5.1.7 Masquerader

This person is not listed in the membership list of a group or conference and through the use of anonymity or pen names may participate without being identified by the other members.

5.1.8 Contributor

A contributor may add conference comments or send group messages but cannot read the other entries in the conference or the other group messages. This is often used by staff support individuals.

5.1.9 Observer

Observer can read conference comments or group mail but cannot create these items.

5.2 Activity Roles

The creator of a specific activity will have a special role which will be a function of that activity. For example, the activity that is used to allow someone to structure a document will allow one to dynamically modify the table of contents of the document, and to reassign members to different composition, edit, and review functions.

Some activities may have multiple roles. In a "list gathering" activity there may be a distinction between those allowed to add to the list of items and those who are only allowed to view or vote on the resulting list.

5.3 Privileges

The ultimate tailorability of CMC systems to support specialized roles, which are made available through "activities" (executable programs that can be integrated into the CMC interface), depends upon the internal flexibility to tailor privileges. A privilege is a primitive operation which is either allowed or not allowed with respect to what a member can do to a communication object such as a message, comment, conference, group, and/or activity. The privileges

needed in a CMC system go far beyond the common operating system privilege concepts such as "read", or "write." In order to allow members of a CMC system to replicate communication alternatives which exist in a physical environment, many specialized privileges are needed to tailor communication structures. Combinations of these privileges can be used to formulate specific roles. Whatever the internal structure of a CMC system, it should accommodate the establishment of primitive privileges which can govern the linkage between a communication object in the data base and individual members. This may be accomplished via the internal membership lists for collection of objects or for activities.

With privileges existing in the internal linkages of the CMC data base, any externally written computer program in any computer language can access the CMC database. Since such privileges are checked by the data base itself, application programmers can produce application code without concern for security or privacy of the objects in the database.

The following privileges are based upon the concepts of objects having internal segments, links existing between objects, and objects located in the memory that is under control of the user or not under control of the user. Also objects may contain executable processes that can be triggered by a user or the system.

5.3.1 Object Privileges

These are the primary privileges that work on any object. They have a structure in which those at the same level are independent of one another. Those at lower levels are implied by the privilege at the higher level. This structure is as follows:

```
Create
Own
  Burn
    Delete
  Replace/Modify
    Execute
    Copy
    Insert/Add
      Append Contribute
      View/Read
        Use
    Link
      Target
```

5.3.1.1 Create

Create is the ability to create a new instance of an object.

5.3.1.2 Own

Ownership privilege is granted to the creator of a given object. It includes all other possible privileges.

5.3.1.3 Burn

The ability to delete an object so that it cannot be recovered. This forces the deletion of all links to the object from other objects.

5.3.1.4 Delete

Delete is the ability to remove the object or object parts from the system. In certain cases real deletion does not occur if links exist to an object from other objects. This action may cause notifications to the owners of linked objects and the possibility of other actions resulting.

5.3.1.5 Replace/Modify

Replace is the ability to modify an object or object part.

5.3.1.6 Execute

This is the ability to trigger executable code that makes use of an object. This allows the object to be moved into the users memory area.

5.3.1.7 Copy

Access to an object or object segment which allows real or virtual extension of the read privilege to other members.

5.3.1.8 Insert/Add

Additional segments may be added to an object. This does not allow the replace operation.

5.3.1.9 Append/Contribute

The ability to insert or add a new segment without being able to view the object.

5.3.1.10 View/Read

Access to an object or object segment with out the ability to extend the privilege to others.

5.3.1.11 Use

The ability of routines to be triggered to "use" another object or a program. However, it does not allow the object itself to be moved into the memory under control of the member. This is vital to insuring security of objects when a member has restricted access to the object.

5.3.1.12 Link

Link is the ability to connect another item to a communication object, so that the retrieval of either object indicates the link to the other object.

5.3.1.13 Target

The ability to view or read the other side of a link.

5.3.2 Specialized Privileges

These are privileges which are associated with specialized features of the CMC environment.

5.3.2.1 Solicit

The right to request input from another member. In some situations this must be granted by the member being solicited.

5.3.2.2 Render

The right to respond to a solicit.

5.3.2.3 Approve

The right to approve the triggering of a process.

5.3.2.4 Reply

The right to link a reply or response to an object.

5.3.2.5 Assign

To create links into other member's objects that provide access to processes to be triggered by the assigned member.

5.3.2.6 Take

To take responsibility for an assign link into the member's own object. Both assign and take are associated with links that govern such things as the passing of roles.

The assign and take are coupled and must be possessed by both parties for action responsibilities to flow from one party to the other.

5.3.2.7 Join

The ability to make oneself a member of a membership list.

5.3.2.8 Sponsor

The ability to add others to a membership list.

5.3.2.9 Act

The ability to act in another role.

5.3.2.10 Index

The ability to modify a given index

5.3.2.11 Share

Share is a privilege applied to objects such as indexes and other lists that an individual member may use to organize material. It allows a member to share such lists or indexes with other members. It also includes sharing of a single role by more than one member.

5.3.2.12 Trigger/Perform

The ability to specify conditional actions that can occur later as a result of another member's transactions.

5.3.2.13 System

System wide privileges for those who maintain the system.

5.4 Tickets

A very useful feature is to allow a concept of "tickets," so a member can transfer a privilege to another user on a conditional basis. For example, giving someone the privilege to modify an entry in a conference that they are not a member of. Specified conditions imposed upon the ticket might be the number of times it can be used or a length of time during which it can be used. This allows professionals and managers to make efficient use of staff support without having to give them access to materials they should not be seeing or dealing with.

Tickets are what one member may grant another to convey a specific privilege. For example a member who has composed a comment in a conference could provide a ticket to someone not in the conference to edit that particular comment.

5.4.1 Conditions

Tickets can be made conditional on a range of parameters. A ticket can be specified to be good only during a certain time interval or to be valid for only a certain number of times.

A ticket may be withdrawn at any time by the person who issued it.

5.4.2 Notifications

Tickets, when used, can be specified to generate a notification back to the person who issued it. In some cases notifications may also be issued to other members. For example, if a member of a conference grants permission for someone else to read certain items in that conference, the conference owner would be notified.

5.5 Extensibility

The concept of primitive privileges that can be used to make up roles is an open-ended concept and very significant to the long term evolution of a system to meet changing requirements. As CMC systems serve large populations and result in interchange among different CMC systems in a network environment, there are many potential privileges

associated with material being transferred or synchronized between different systems. Therefore, it is important that the internal structure of a CMC system accommodates this sort of evolution.

Roles and tickets are, therefore, also open-ended concepts which may be extended with the evolution of the system.

5.6 External Access

The existence of internal privileges within the database of a CMC system makes it possible for application programs in other languages to call upon the data within the CMC system without violating the privacy structure imposed by the privileges.

6. Conferences

The heart of the working space for a group is a conference or a set of conferences. There may be many different conferences for the group, each serving a slightly different sub-objective. By making choices on the structures and facilities available for a conference, it is possible to tailor a conference for a wide range of group communication objectives.

6.1 Conference Types

The most typical conference types that have been demonstrated in existing systems are:

6.1.1 Discussion

Discussion oriented conferences have a relatively high degree of freedom and equality among all the participants. Conferences for small group discussions tend to be best served by a highly linear structure while those for very large groups of a 100 or more need branching structures and indexing. Discussion conferences must organize the comments by comments and replies to comments. They must also allow association with other text items which may be in other conferences. It is also important to place some sort of limit on the size of comment. Typically this size limit should be in the range of 20-60 lines. Attachments may be used to allow for larger items. Too long a comment inhibits the discussion nature of the conference flow. The id numbering of comments is assigned automatically by the system.

6.1.2 Collaborative Composition

Composition conferences are dedicated to facilitating collaborative composition. They require a role structure that allows assignment of creation and editing roles by individuals and by segments of a conference.

It is desirable to have facility that allows an outline structure to be pre-imposed upon the conference and the designation of roles by segments of the outline. In a composition conference the comment number assignment may be done by the writer.

6.1.3 Project Management

Project Coordination conferences require the ability to update and reorganize the material along some given category of work efforts. They may also require the ability to incorporate structured quantitative data with the qualitative textual data.

Utilization of a fixed index set of keys is desirable in this case. Multiple reply levels may be used to categorize typical project management information. For example the root is a task, each first level reply is a sub-task by a given individual, and each second level reply is the updates on the status of this sub-task. For more

complex projects, specialized tracking activities need to be provide to support this type of conference.

6.1.4 Inquiry Conferences

Inquiry conferences are structured for unpredictable information exchange. A large group of individuals who are engaged in making and answering inquiries about a specific area. For example, sharing information about problems and solutions for utilizing a complex information system.

Usually the root comments are constrained to be very short (e.g. 10 lines) and are a statement of the basic inquiry. All the information, that other individuals contribute, is entered as replies to that inquiry. The necessary feature is that members of the conference can designate which inquiries (root comments) they wish to track. For those they do not wish to track, none of the replies will be delivered to them as new items. It is also necessary to have an indexer control the consistency of the keys on the root items for later retrieval.

In certain types of information exchange where there is some degree of quantitative data involved, it is desirable to have data forms that can be standardized and filled out to supply replies.

6.1.5 Collaborative Data Gathering and Validation

Conferences dedicated to gathering subjective quantitative data such as budget estimates and their associated discussions. Such conferences must have the facilities for structuring quantitative data and linking that data to comments.

It is also desirable to have activities which allow the structuring of the data into columns and tables. These would be collaborative data structures in that different individuals may be responsible for completing different entries in a column or table of data.

6.1.6 Collaborative Learning

Conferences which are structured to provide courses and seminars (i..e, Virtual Classroom). There is a wide range of useful activities that are associated with this type of conference. For example, Response/Question activities force students to reply to a question before being able to see the replies of others. It is necessary to provide tracking of who has and has not done various activities (e.g. assignments).

6.1.7 Gaming and Role Playing Conferences

Conferences which are structured to allow the playing of a game such as simulating a company and making decisions. Each member assumes a role in the game and are not identified by their real identity.

The person controlling the game should be able to pre-establish items such as roles, role descriptions, a list of events and their descriptions, etc. The game controller needs to be able to control

the introduction of events and alternative occurrences from a file he or she can draw on as the game progresses.

6.1.8 Publication Conferences

A publication conference is one where there is a small number of writers and the majority of the members have only a read status. There are many cases where this is an extremely useful form of a public conference (i.e. a newsletter).

Another desirable alternative structure is where root comments can only be entered after they have been submitted to the owner. These root comments are Document/Read Activities. Any member, however, can reply to such a document.

6.2 Structure

A conference, as a working space to meet a specific objective, can be structured in a number of different ways. The resulting structure influences the efficiency of the conference communication facilities for reaching specific objectives. The typical parameters that one can adjust and tailor when establishing a conference are as follows.

6.2.1 Membership and Roles

The memberships and roles of individuals are established and modified by the owner. However, any member may "unjoin" a conference they belong to. Also, public conferences maybe "joined" by any member of the system. Conferences may also specify that a whole group is a member. This allows any member of the given group to "join" the conference.

6.2.2 Levels and Comment Size

Conference comments usually have a number of association or reply levels. For example, comment 24.5 would be the fifth reply to comment 24. The owner of a conference should be able to specify the number of levels allowed and the size of the comments at each level. In a composition conference fairly large sized comments are allowed. In a discussion conference, the comment size may be limited to a few screens, as long comments break up the cognitive flow of the discussion.

6.2.3 Role Distribution

In a composition conference the user should be able to restrict roles to fixed ranges of root comments. This way one can assign selective composition and review responsibilities to different sections of a document.

6.2.4 Activities

The major mechanism for selective tailoring of the conference structure is the introduction of activities. By choosing the types of activities and when they are used, the owner or organizer of a conference has considerable flexibility in both assigning what has to

be done and in providing the ability of the group to track the progress of the effort. This ability to determine the nature of the specific "activities" that occur in given conferences and when they should be activated provides and open ended method of evolving the system.

6.2.5 Forms

The introduction of a forms facility to allow the gathering of structured information from different members of the group. This should allow the specification of a data form that can be attached to a comment. When it is triggered by a member it creates a new reply that contains the data supplied by the member.

6.2.6 Index

The conference index is automatically compiled out of the keys that authors place on their comments. The conference may be set up with "free keys" where any member may use any term, or with "fixed keys" where key terms must be selected from those that already exist in the index as set up by the owner or indexer. In the fixed key option there should be a mechanism that delivers proposed keys to the indexer and allows him or her to accept or reject the proposed addition to the fixed key list.

6.3 Comment Structure

The core of CMC systems is the communication objects which carry actual content between the members of a group or team. These are messages and conference comments. The structure of messages should be consistent with that for comments. There are four distinct parts that can exist for a given message or comment.

6.3.1 Abstract

The abstract is all the status information associated with a message or comment. It includes:

6.3.1.1 Identifications

This includes the identification number for the message or comment; name and identification of the author and any editor. If it is a message, the identification of who it was sent to is also included unless it was "blind copied."

6.3.1.2 Content Information

The title and keys placed on the item by the author. The type of item and/or the type of activity or attachment that might be linked to the item.

6.3.1.3 Date-time

The date and time the item was created or modified.

6.3.1.4 Title

The title is a single line imposed by the author to describe the subject of the comment or message.

6.3.1.5 Keys

The keys are those imposed by the author or the indexer and they are compiled into the conference or mail index.

6.3.1.6 Header

A header is a two line summary of the abstract information that contains the identification of the item, who and when it was created, and the subject line. It is used when in those situations where the member desires to get as compact a list of messages or comments as is possible.

6.3.1.7 Status

Estimated size of the item, the number of replies that currently exist, status with respect to appendages or attachments. What constitutes the status of an activity depends on the type of activity. For example, in a list gathering activity the status would indicate how many items had been contributed to the list and when the cut off date is for further contributions.

6.3.1.8 Use

Internally it is useful to keep the date that the item was last viewed or used. This is useful for routines to aid in finding what material to delete in a long standing conference.

6.3.2 Content

The actual content of the communication item. In most CMC systems members are able to designate whether they want to see the content after reviewing the abstract of an item. The contents will usually include text and may include graphics and other types of digital data. However, since the ability to handle mixed data types varies with the equipment utilized for interfaces, data other than text may be handled by attachments.

6.3.2.1 Appendages

Appendages to the original text item made by various readers. Appendages are added segments to an object and the process of creating an appendage does not modify the contents of the original object. These appendages have a number of possible forms.

6.3.2.1.1 Reactive Notifications

Expressions of reactions, such as agreement, disagreement, approval, etc. with the content of the item. Such expressions are identified by the user in the group that added the appendage. They are created with the notification process.

6.3.2.1.2 Delta Edits

Delta edits are alternative wordings to a particular part of the content, and are linked to that content. Therefore, the receiver may view the original and the selected rewording contained in the delta edit.

6.3.2.1.3 Marginal Notes

Marginal notes are comments made on the content and linked to a given position, but which are not considered part of the formal content. For example, a marginal note might say that a certain set of sentences is unclear, but not suggest a replacement alternative.

6.3.2.1.4 Virtual Linkages

These are Hypertext type linkages which are made at given points in the content and which may be used to add other material in a virtual and/or conditional manner to the existing content.

6.3.3 Attachments

Attachments are passive objects that may be attached or linked to a root object such as a message or comment.

Attachments serve a wide variety of functions. They may represent an attached graphic or an attached binary file produced by a special software package. Usually the contents of the comment or message will describe the specific nature of the attachment. The types of attachments that are possible are as follows:

6.3.3.1 Files

Files that are to be transferred to the member's workstation or personal computer before they can be viewed or utilized. These might be binary files for graphics or the output of various workstation based software packages. These could also include other media such as digitized voice or the digitized output of instrument readings.

6.3.3.2 Long Text Items

Very long text items that the sender describes in the content in order to give the receiver the opportunity to decide whether or not to display the longer attachment.

6.3.3.3 Other objects

Other objects, such as conference comments, messages, directory entries may be used as an attachment. Any object having a unique identification can be used as an attachment.

6.3.4 Activities

Activities are active attachments while the standard attachment is passive in nature. Activities are executable procedures which aid in the structuring of the discussion of a group, or which facilitate the

ability of individuals to handle large amounts of information. While one may "view" a comment or message, one would "do" the linked activity. For activities, the content of the comment or message would usually provide information about the activity.

6.3.5 Notifications

Clearly a great deal of the adaptability of structures in a CMC environment rests with the ability to use a text item in a number of different ways. Associated with this variety of utilization is the concept of notifications. For example, when someone modifies another person's item, the original author should be notified by the system that this has occurred.

The specific notifications that are generated by the conference are as follows.

6.3.5.1 Establishments

A user is notified when they have been made a member of a conference or when someone has replied or appended material to one of the members comments.

It is up to the conference owner to decide if an establishment notification should go to the other members of the conference.

6.3.5.2 Modifications

Modifications to a comment by a member other than the author would cause the author to be notified of the occurrence.

Modification notices about a message or comment would go to any receiver who has already accepted (viewed) the original version of the item.

6.3.5.3 Removals and Deletions

A member is notified when he or she is removed as a member of a conference or when an items he or she has authored is deleted.

Authors of replies are notified when the root is deleted. The conference owner can designate that replies are to be deleted when a root is deleted but the system needs to provide a grace period for the author of replies to decide if they want to save any of them.

7. Activities

One of the necessities for a CMC system to benefit group oriented objectives is the integration of other computer resources within the CMC environment. Another is the incorporation of various collaborative type facilities for use by groups. Both these goals can be accomplished through a single metaphor: the concept of "activities."

An activity is the ability to attach executable code to a conference comment or a message. The receiver may "view" the comment and decide whether or not to "do" the linked activity.

7.1 Objectives

What an "activity" can be is a very open ended concept. Some key activity objectives are as follows:

7.1.1 Decision Support Tools

These are tools that collect, process and display "votes" such as weighting, ranking, or yes-no "straw votes" on options. They also include tools to organize material into categories relevant to the group problem solving process.

7.1.2 Integration of Information Systems

Members of a CMC system should be able to bring data from other databases into the communication environment. Activities to service this objective provide data input forms that are tailored to collecting inputs to database systems and to triggering the delivery of these inputs to the database and the return of the output in the form of a message or comment. This may include models and analysis routines as well.

7.1.3 Collection Process

These are activities that collect and organize material supplied on a collaborative basis. The "list gathering" activity described below is an excellent example.

7.1.4 Tracking of Actions and Responsibilities

These are activities designed to track the actions of the members of the group. For example, a typical project management activity would allow the entry of new tasks to accomplish, individual groups members to indicate the tasks they are taking responsibility for, and to later indicate the status of the task.

7.2 Integration

The future direction for group support in the computer environment is towards the integration of communications and all other computer

resources into a single interface structure. There are many approaches to integration with the underlying technology. We use the metaphor of an "activity" that can be attached to any communication item such as a comment or message. This activity, when triggered or done, will execute a program or procedure on the host computer or the network of computers. Such an activity could ask the person using it to supply input data, and generate a new communication item to receive the output of the resulting program.

As long as the above is implemented as a general facility, it can be used to easily trigger requests and searches of databases, execute programs that perform analysis, or make changes to databases. The original communication item containing the attached activity can provide a description of the activity or a summary of its current status.

The integration of these tools within a CMC system requires that the system keep track of the status of various activities being used by the group.

The associate concept of "notifications" is a key to providing signals of the tracking process and encouraging timely use of activities. However, the system must also provide for each individual user a general status tracking facility which provides the following types of status indications.

7.2.1 Inherent Status

These are the states that an activity can have on an absolute bases. These states are set and regulated by the member who created the activity.

7.2.1.1 Open

The activity is open for use by the members based upon their access rights to the message or comment with which the activity is associated.

7.2.1.2 Frozen

The activity has been restricted from any further changes by anyone having access to it. It may still be viewed.

7.2.1.3 Closed

The activity is restricted from any access, even viewing.

7.2.1.4 Sequenced

This activity cannot be done by a member unless they have done a prior activity leading to this one.

7.2.1.5 Required

A member is required to do this activity before he or she can proceed with the group task. The level of the restriction may still be

selected. It might apply only to activities in a conference or it might apply to reception of new comments. For certain activities this status would prevent the member from declaring the activity "done" or "ignored."

7.2.1.6 Optional

The activity is optional for the members of the group task. Activities that are not "required" are automatically "optional."

7.2.2 Member Relevant Status

These are the specific status states that are relevant to an individual member and dependent upon the actions he or she takes with respect to the activity. As a function of the particular activity and its inherent status these status states may be set automatically or set by the member. These states are necessary for the individual to track his or her interaction with the activities and for the conference owner to determine the overall group participation in the set of activities established in a given conference.

7.2.2.1 Undone

The member has not done or started the activity.

7.2.2.2 Incomplete

The member has started but not finished the activity. In a document/read activity, if a member chooses to read only a part of the document the system would set the status to "incomplete." In some cases the member can choose to designate this state. For example, if the member has read the whole document but wishes to be reminded to come back and look at it again, he or she could change the "done" state to the "incomplete" one.

7.2.2.3 Undetermined

The state of the member relative to the activity can not be determined currently but it has moved out of the undone state. Choosing the "no judgement" choice on a vote would trigger this state for a voting routine.

7.2.2.4 Ignored

The member has chosen to ignore the activity and does not plan to do it. This is a state the member can choose unless the activity has been declared "required."

7.2.2.5 Done

The member has completed the activity. The member could choose this state after reading only part of a document but could not do so for a "question" activity if they have not answered it.

7.3 Example Activities

A number of specific activities have been demonstrated in various conference systems. The following examples are meant to serve as an illustration of some that are useful for a wide range of applications. In some cases activities can be viewed as the composites from a fundamental set of tools.

The first activity is presented in some detail so that the types of control and regulation that the person creating the activity needs to have in many group oriented activities is clear.

7.3.1 List Gathering

The first tool needed for most group problem solving processes is the ability to collect a list of structured items and to treat this collection of items as one list. An example of a list is the table of contents of a document, such as the document the group is trying to create. Another type of list is a list of tasks to be done. In addition, there could be lists of issues to address, terms to define, alternative criteria for a decision, possible solutions to a problem, etc. List gathering is a very fundamental activity in most collaborative situations.

How to handle the contributions to a list varies with the nature of the objective.

7.3.1.1 Free Addition

Any member can add an item to the list at any time.

7.3.1.2 Limited Addition

Members can only add a certain number of items to the list or only certain members can make additions to the list.

7.2.1.3 Structured Additions

The list has a sub-structure and addition rights vary with the sub-structure.

7.3.1.4 Taking Responsibility

Individuals can be assigned by others or they could volunteer to be associated with certain items on the list. The number of associations allowed per individual is also a parameter. This would typically be added for a task list so that individuals could take responsibility for the tasks defined in the list.

7.3.1.5 Item Status

A status variable and date variable can be associated with items in a list so that one could track the status of an item on the lists and changes with time.

7.3.1.6 Control

In addition to changing the inherent status of an activity, each

activity type may include certain special options that the creator of the activity needs to control dynamically. For example, in this activity the member may decide to freeze contributions to the list and to add one of the following options as additions to the activity.

7.3.1.6.1 Voting

Provides an appropriate voting routine for a list of items (e.g. ranking, categorical classification, ratio scaling, etc.).

7.3.1.6.2 Sub-discussions on List Items

Allowing other text items to be associated with the individual items in the list in order to gather specific feedback about the items.

7.3.1.6.3 Reordering

Reordering and arranging the items on the list according to some criteria resulting from voting or other processes.

7.3.1.6.4 Transferring

Moving the results of the list gathering activity to another conference as comments or as input to initializing another activity.

7.3.1.6.5 Format

The ability to view a very tight summary of one line per item on the list to view all the details of an item on the list, and/or viewing all the linked information to any item on the list.

7.3.1.6.6 Membership

The ability to view who has made what contributions to the activity and who has not. This information might be open to all those participating or it might be restricted to the creator of the activity.

7.3.1.6.7 Notifications

Typically the creator of an activity would get a notification when anyone had made an addition to the list or taken responsibility for an item on the list. The creator could designate that such notifications can be delivered to all the members of the conference in which the activity resides.

7.3.2 Data Gathering Activity

Another important class of activity is the ability to design forms for gathering structured data and to associate a given form with a given activity. "Doing" the activity results in a request for the member to fill out the form. SGML, which is discussed later, is an excellent vehicle for designing forms. The activity can be structured so that upon completion of the form, the data is directed elsewhere on the computer system, or becomes a related comment or response to the original comment containing the activity.

Data gathering can include the situation where different individuals are supplying the same subjective data or estimations such as for a budget plan. This type of activity can include the requirement for the activity to make comparisons and summarize the degree of agreement or disagreement on the estimates being supplied. One conception of this would be a "collaborative spreadsheet" where there is a unique version of the same spread sheet for every member supplying the estimate.

In another version different members can have responsibility for filling in different data on the same form. In some cases this fill-in procedure has to proceed sequentially when certain data is dependent, in part, on the prior filled in data.

In the Virtual Classroom application the instructors Gradebook is a data gathering activity where only the instructors can fill in the data and view the entire form. The students may only view selective data which represents their own grades and the averages for the class as a whole.

7.3.3 Task Selection

This is a special case of the list gathering activity and extremely useful for any type of project management situation. While it may use the same tools for some situations where tasks are interrelated, the version of this required in some applications might have to support a representation of the task interdependencies.

7.3.4 Question and Issue Discussions

In educational applications and in brain storming discussions it is desirable to have an activity which requires individuals to contribute their discussion comments before they are allowed to see the answers that other individuals entered about the question or issue. This forces each individual to think the issue through for themselves before responding.

7.3.5 Document Delivery

A large document should not exist as the content of a comment or message. A comment should contain only an abstract of the document. The attached document activity would be triggered to deliver portions of, or the entire document. When triggering or doing a document activity the member should be provided with a table of contents and be allowed to select the portions they wish to view.

The next step beyond the "table of contents" is the provision of documents that may be organized with Hypertext type linkages. Such documents would make available an index of keys which would provide a choice of entry into the document.

7.3.6 Voting

There is a need for providing the most popular types of voting scales. These include: yes-no agreement votes, 1-N scales, rank

ordering, categorical scales, ratio scales, and subjective estimations such as probability, time, etc. In general, voting on the contents of a single comment should not require more than two scales (e.g. desirability and feasibility for a proposal).

7.3.7 Surveys

The ability to provide general surveys is also useful. These should be created out of the basic voting scales with some additions such as "multiple choice" and "text only." The added complication with surveys is providing a general analysis routine for scoring the survey.

7.3.8 Exams

Exam activities have the added feature of being able to set a time limit on the person taking the exam and to provide controls on execution of the exam.

7.3.9 Routing Activities

These are activities that cause the results of doing the activity to be delivered somewhere else. For example, an activity might be designed to gather approvals from a set of individuals. Upon completion, the activity triggers the delivery of the original content to some other location in the system.

In the Virtual Classroom, the assignment activity automatically delivers the students assignment to the proper place in the personal notebook of the instructor. It is a mechanism for granting a student the ability to contribute his assignment to the instructors file without being able to see the contents of the notebook..

7.4 Notifications

Each type of activity can have its own tailored notifications integrated with it. For example, in voting no one is allowed to see the votes until a minimum number of votes are collected. As a result, when this threshold occurs the activity should generate a notification to those who have voted that the votes are viewable. For documents, a notification usually goes to the author anytime another member has read the document.

Since a notification can be used to retrieve the item it is about, one can use the notification about a new activity or a change in an activity status to automatically go to the comment that has the activity or to obtain the new information in the activity.

7.5 Group Graphics

Given that a CMC system can store graphics as attachments, a long term objective of a conference system is to support "group graphics," where a number of different members of a group can work on the same diagram. This requires a number of underlying capabilities. First, the approach to the storing of graphics must represent the resulting diagram in a higher level specification that stores each object as

the original drawer created. In other words, others working on the same diagram must be able to change or edit it in the same manner as it was created in the first place. An example of this is the NAPLPS standard.

The graphics area presents a number of open ended possibilities for specialized activities as illustrated in the following.

7.5.1 Icons

A key feature for allowing collaborative group graphics is to incorporate the ability of a group to arrive at standards for "icons" which can represent the elements of the problem they are dealing with. These icons can then be used as macro level concepts whose position and relationships in a diagram can be compared across a number of different diagrams by different individuals. A group needs to be able to form its own set of "jargon" in the graphical mode.

7.5.2 Templates

Templates are activities which draw for the user. They allow the person to specify the parameters of the template and the resulting drawing is created automatically. Examples are any form of chart or graph. However, this can involve much more complex structures such as laying out a network.

7.5.3 Layouts

Layouts are a higher level construct made up of a diagram and a set of icons. Members of the group are only allowed certain operations on their copy of the layout. For example, they might only be concerned with how to place the icons in the diagram (i.e., laying out an assembly line given icons for various types of workstations). They might also be concerned with the interconnections made between the icons (i.e., laying out a flow chart). Given this type of construct it is possible to have analysis routines which will automatically assess for group feedback the degree of agreement or disagreement on different conceptions the individuals have about the problem.

7.6 Extensibility

The concept of activities, within a CMC system, is an open-ended concept and can be referred to in other terms. It is crucial that the incorporation of a wide range of tailored facilities to support an application be provided via a common interface metaphor, with the same command functions and object definitions applying to the whole set. This is the only way that all the members of the group can quickly acquire skills and learn the tools as they carry out the application. The related concept of notifications provides a single facility through which the progress of any type of activity can be tracked by the members of the group.

8. Notifications

In most conference systems there is some way to provide individuals with concise information on the occurrence of transactions. These have appeared under various names such as confirmations, reminders, and notices. In group efforts it is very crucial that individual members of the group be alerted to what is taking place and to any change in the status of the work to be done.

The process of transaction notification, which we refer to as "notifications," should be viewed as open-ended. Over a period of time most functional extensions to a CMC system necessitate the introduction of new types of notifications. The interface and handling of notifications should remain constant, and only the types of notifications change with the evolution of a system or with the changing nature of a group's activities.

8.1 Objectives

8.1.1 Conciseness

Notifications should be short and allow a person to view a list of these short notifications to get an indication of the scope of things that are happening that are of concern to him or her.

8.1.2 Direct Manipulation

The notification should represent a "handle" for the information it is about. A member should be able to "point" to the notification and ask for the object it refers to. For example, if a notification indicates that a vote is now viewable it should allow the member to request that vote summary from that point in the interaction.

8.1.3 Tracking

The member should be able to reorganize the notifications so that the history of notifications about a single activity can be viewed together. Current notifications should represent a personal database for the individual member.

8.1.4 Signaling and Cueing

Notifications are a mechanism for supporting the process of signaling what is happening to members and groups.

8.1.5 Information Overload Reduction

Notifications aid in reducing information overload by better organizing the flow of information.

8.2 Functionality

8.2.1 Data

All notifications should identify when they occurred, what object generated them, and what they are about.

8.2.2 List Processing

Memebers should have various list processing tools to manage their list of notifications.

8.2.3 Local Store

Notifications are not maintained on a group bases, only in the member's local store. Therefore there is no master copy of a notification. A member should be able to manipulate this list as they see fit.

8.2.4 Organization

Notifications should be organized by major object type in terms of delivery of new notifications. Individuals should receive the notifications about a given group or conference as a block of notifications. They should also be able to organization their notification list by major objects and activities.

8.3 Types

8.3.1 Automated

These are notifications which are automatically generated by transactions occurring in the system.

8.3.1.1 Establishments

Any time an object is created it might trigger notices to others. A reply might alert the author of the original comment. A new group conference might alert the members of the group. When a person is made a member in a conference, group, or membership type activity, they would also receive a notification.

8.3.1.2 Status Changes

Many activities go through changes of status that should be conveyed to the members involved with the activities. There are many other types of status changes (e.g. changing a private conference to a public one).

8.3.1.3 Modifications

Any time an object is modified or edited, a notification is generated to those who have already viewed it and taken it off their new item list.

8.3.2 Selective and Reminders

These are notifications that can be selected by the member with the privilege to do so. For example an author might choose if he or she

wants or does not want to be notified of readers of their document. Reminding just those that have not done a specific activity could be a function triggered by the creator of the activity.

It is possible to create and delay the delivery of a notification until some future date and time. This also serves the purpose of creating selective reminders. In some cases these can be designated as conditional. For example, setting up the triggering of a notification at some future date to go only to those who have not completed an activity on that date.

8.3.3 Canned Reactions

The reader of a comment or message can choose from a list of canned notifications and associate the chosen notification. The "message" of the notifications can be tailored for a specific system. These might be things like: I agree, I disagree, feasible, not feasible, applause, boo!, etc.

The intent of these is to minimize the traffic in the form of longer messages and comments and to provide the opportunity to convey various standard reactions and social-emotional content with a minimum of human effort.

Canned reactions can be addressed to only the author, all the readers, and/or appended to the original item they refer to.

8.3.4 Composed Notifications

These are short one or two line messages which are composed by a given member and sent to other members.

8.4 Extensibility

The process of notifications should be implemented with a general purpose notification generator so that future changes and additions to the system can easily be designed to incorporate new types of notifications tailored to new facilities.

8.5 Marking and Indexing

A member should be able to mark a notification and to later collect all marked notifications as a single list. This may also be accomplished by being able to index notifications within the members personal index.

9. Message System

The main objective of including a message sub-system within a Computer Mediated Communications system is to compliment the objectives of the conference system. Conference discussions should be focused on the topic of the conference, not cluttered with entries that stray off the subject or are transitory in nature.

In the activities of a group there are appropriate communications for the group as a whole in addition to appropriate communication for selected subsets of members. Therefore; messaging has to be an integrated part of any conferencing facility, without any significant difference in interface, in order to conveniently utilize both capabilities.

9.1 Objectives

9.1.1 Scheduling

Making arrangements for meetings and other events associated with the group's effort.

9.1.2 Individual Communications

Allowing communications among individual members rather than the group as a whole.

9.1.3 Socializing

Providing a mechanism for social-emotional content exchanges.

9.1.4 Facilitation

Carrying out facilitation activities such as inquiring why a given member has not made any contributions yet or trying to encourage more activity from a given member. Allowing the facilitator of a conference to encourage participation through individual communications to members of the conference.

9.1.5 Tentative Exchanges

Reviewing drafts, ideas, uncertainties, and tentative concepts before committing them to a conference.

9.1.6 Distribution

Providing selective conference information to non-members of a conference.

9.1.7 Negotiating

Negotiating consensus and agreements on a selective basis.

9.1.8 External Transfers

Being the primary vehicle for accepting inputs from external message systems.

9.2 Functionality

To accomplish the above objectives, a message sub-system must supply the following functionality:

9.2.1 Group Addressing

The ability to easily address messages to a large group by providing ways to use a single address term to carry out the addressing. This may be provided in a variety of ways: formal groups, interest groups, and personal substitution index keys.

9.2.2 Conference Addressing

It should be possible to use the identification of a conference to address a message to all members of the conference.

9.2.3 Delivery Status

Members need to be able to determine who has received or not received an item of mail.

9.2.4 Exchanging Material

The contents of a conference comment and the contents of a message should be easily converted from one to the other. The user should be able to copy a message into a conference comment and vice-versa. A tentative idea shown to a small number of individuals in a message may later need to be transferred to a conference discussion.

9.2.5 Virtual Referencing

One should be able to virtually reference or "attach" another text item in a message, so that it may be viewed as part of the message without actually copying the attached item. This allows users to directly incorporate draft material in their personal composition space. In a well integrated system this might also allow direct incorporation of data reports from a separate database.

9.2.6 Message Store

Messages should be available in a central file for a month or more so that members do not have to judge the value of them and make decisions on storing them at the time they are received. Experience has shown that until a sequence of communications has taken place over some span of time, particular messages in the sequence cannot be judged for value. The first impression on the value of a message by a member can often be wrong.

9.2.7 Message Structure

Messages should have the same structure as a conference comment and be handled by the same interface functions.

9.2.8 Anonymity

A member should be able to send anonymous messages or use a pen-name. Receivers should be able to reply to such messages without being able to detect who they are actually from.

9.2.9 Reserved Category Keys

There should be a facility to establish system wide reserved category keys such as "urgent," "personal," etc. These may be used by receivers of mail to categorize incoming messages.

9.2.10 Additions

The creator of a message should be able to designate if additions can be made by any or all of the receivers. Such additions are appended notifications and attachments.

9.2.11 Replies

Replies to the same message must not be allowed to utilize the same keys as on the original message. This reduces the amount of material retrieved in any search of message keys. Since the root message should indicated how many replies exist and the identification of the root can be used for retrieving replies, there is no necessity to duplicate keys.

9.3 Message Types

The following types of messages are distinguished in a CMC system.

9.3.1 Private

Messages sent to one or more members on an individual bases.

9.3.2 Group

Messages sent to the identification of a group and delivered to all members of the group.

9.3.2 Conference

Messages sent to the identification of a conference and delivered to all members of the conference.

9.3.3 Interest

Messages that are addressed by use of interest keys and sent to all members identifying themselves with that key.

9.3.4 Topic

These are addressed by the use of topic keys and go to the owners of

conferences or groups associated with that topic.

9.3.5 External or Contact

Messages sent to addresses which are external to the CMC system or which are received from external contacts.

9.3.6 Public

Messages open to all members of the particular system. They are not automatically delivered as part of new mail. Only a notification of a public message, providing the title and id, is sent to all members and a member may select whether or not to retrieve it.

9.3.7 Tailored

CMC systems need to provide certain tailored types of messages. Examples of these are messages that are routed in sequential manner to the list of addressees and which might incorporate approval actions by some subset of the receivers. This sort of tailoring can be done by a "forms handling" subsystem which has the ability to generate instructions to the CMC system as part of the execution of the form.

9.4 Searches

Message searching should provide the following types of capabilities.

9.4.1 Members

Searching by who wrote, received, modified, or appended a message.

9.4.2 Words

Messages should be searchable by keys, words in the title, and words in the text. Searches of text should allow searching by position in the text to allow for efficient searching when the content is based upon structured forms.

9.4.3 Date-Time

Messages should be searchable by the date and time when they were created or modified.

9.4.4 Status

Messages should be searchable by type and status of message with respect to whether they have been received, appended, contain attachments or activities, etc.

9.5 Message Notifications

In many message systems it is felt to be a violation of privacy to let authors of a message know when a receiver has actually received the message. In terms of facilitating the objectives of group cohesion, rather than individual privacy, it is extremely desirable

that the sender know when a member has received an item. Very often it may trigger the need for a follow up message. In some group oriented systems, for example, a distinction is made in issuing notifications as to whether a receiver only looked at the abstract of the message before removing it from the "new mail" queue or whether they actually asked for the content to be displayed. The latter is preferable to facilitate a group orientation.

When a message has been appended with a notification, a notification should go to all who have already received it as well as the author indicating the content of the notification.

The basic concept underlying the design of other specific message notification capabilities should be that one wishes to create a group atmosphere and a cooperative group that knows the system is informing participants about the activities critical to supporting the group objective.

9.6 Transferability

One needs to be able to transfer material in messages into conference comments and visa versa. This also includes the internal structures of appendages, attachments, and/or activities. As a result the copy or transfer functions must provide options for the member to indicate whether all of the segments of the message are to be transferred or if only certain ones are to be transferred.

9.7 External Consistency

There is a need to be able to transfer material between systems. When messages are to be transferred externally, the sender needs to be able to designated whether items linked in a virtual manner are to be incorporated into the actual contents to be transferred. In some cases this might be the incorporation of only a reference (e.g., abstract) to the linked item.

10. Text Formatting and Processing

A fundamental problem associated with CMC systems and group activities such as collaborative composition is the consistent formatting of text. A composite document, made up of the contributions of a large number of writers, has to "look" the same in all sections. Each receiver or reader needs the option of having the text presented in the format they wish to view it.

10.1 Objectives

Whatever the facility for expressing the formatting, there are a number of criteria that are desirable in a collaborative environment. These criteria become more important as the group deals with the collaborative composition of larger and larger documents.

10.1.1 Visibility

The specifications for text formatting should be visible if the reader or editor of an item wishes to see them. This allows one person to easily modify another individuals writings.

10.1.2 Manipulation

The writer should be able to edit the text formatting specifications in the same manner as he or she edits text. The formatting specification should be independent of any particular editor. This will minimize the number of facilities that must be learned in dealing with text documents.

10.1.3 Relative Specification

Formatting specifications should be relative and never absolute. Absolute formatting should only be specified for a given output device. The original text should be adjustable to different absolute specifications by individuals when they want to output a text item.

10.1.4 Drafts

The user of a CMC system needs to have the ability to deal with multiple unfinished text items in draft state. Even when answering a message the member may have to compose the reply in pieces. Furthermore, a person composing text may always be subject to interruption in the task inorder to take care of higher priority items.

10.2 SGML Recommendation

The logical choice to satisfy this requirement is the Standard General Markup Language (SGML) that has been adopted by the American Publishers Association. Individuals who are editing material written by other individuals will be able to see the markups as they were created by the original author. Specification of a paragraph or

other entity carries with it no absolute size or indentation values. Such values can be specified by individual members at the time they wish to view or produce a hard copy of the document.

Within the context of a given CMC system, only a subset of the SGML specification needs to be implemented. The basic functions having to do with paragraphs, headings, tables and columns of information, and the linkage capabilities to stored graphical data are some of the crucial items. Powerful implementations of SGML are becoming available on personal computers. After a document has been drafted, the final document production can be done at an appropriate workstation. In fact, the subset of SGML to be used in the collaborative group processes should be kept simple and easy to use. A subset of SGML that can be described briefly on one sheet of paper would be the target for general usage by all members of the group.

10.3 Extensions

SGML provides a basic framework in which extensions to the specification can be made, in order to meet the needs of specialized applications. SGML itself has no specific capabilities to support the needs of collaborative composition. It is our recommendation that extensions be added to the basic SGML which will function within the context of the specific CMC system for the purpose of facilitating the collaborative process. Such extensions would be removed by the CMC system when text is transferred to another system.

Such capabilities considerably reduce the amount of traffic that must take place in a working group through the use of messages and comments. Also, directly linking these items to the text they are referring to greatly facilitates the ability of members of the group to follow what is taking place with much less confusion. The specific extensions that are recommended are:

10.3.1 Delta Edits

Delta edits are alternative wordings to an existing part of the text. Such markups must mark the beginning and end of the original as well as the beginning and end of the suggested replacement.

10.3.2 Marginal Notes

Marginal notes are comments useful during the drafting activity but not to be considered part of the final document.

10.3.3 Linkages

These are links from one object to another which are embedded in the text or graphics and can have a semantic meaning. This would allow individuals to link material that needs to be cross referenced during the drafting phase, and which may or may not later be converted to a standard index reference for the automatic compilation of a final index.

10.3.4 Appended Notifications

These are additions to the body which reflect upon it but are not an integral part. They usually represent meta comments expressed by the readers or members of the drafting team.

10.3.5 Conditional Linkages

Conditional linkages are links to other objects which can trigger processes based upon various conditions. For example, the linkage could cause the linked object to be merged into the material being viewed by the reader if it happens to be an object that the reader has not already seen. It could also be a linkage that causes a survey to be trigger if the reader is one of a select subset of the readers who are to take the survey.

10.4 Editing

A CMC system should provide a subset of editing features for the quick correction of mistakes. Some of these editing features should work on a global bases. This means that the replacement of a word or term could be made across a number of different text items or through the full collaborative document.

The very basic functions that should be provided are:

10.4.1 Replacement

Replacement of a string by another string over some range of text or text items.

10.4.2 Deletion

Deletion of a string from a beginning to an ending point (i.e., specified block deletion).

10.4.3 Insertion

Insertion of a string or block at a given point in the text.

10.4.4 Moving or Copying

Movement of a block or string within a text item and between text items.

10.5 Virtual Documents

With the ability to link text items to positions within text items (e.g. Hypertext), the ability to create, move, and delete text by creating, moving, and deleting links should be considered a minimum CMC capability.

In some prior systems the ability to make links conditional has shown to be very desirable. For example, a link which virtually places a piece of text within a given piece of text can be conditional on whether the given reader has separate access to the piece of the text. This reduces the need for readers to see something twice unless they specifically want it to appear on the screen.

10.6 Scratchpads

The system should provide a series of scratchpads that the member may use to draft items. Information stored with the scratchpad should indicate what the original composition status was (e.g. replying to a specific message or comment, creating a root comment, responding to an activity or form, etc.).

These should be available in such a manner that the member can review a list of the drafts he has in progress and can choose which one to continue working on.

The system default should be to save any incomplete composition task as a new draft unless the member takes specific action to delete it.

11. Other Functionality

11.1 Collaborative Hypertext

One of the primary advantages that a computer can provide to a group, that is trying to collaboratively compose a large document, is the ability to link text items in very different ways than is possible using paper and pencil.

One does not have to look at a document in a sequential manner reflected by the primary page order of the document. Instead, there can be "lateral" or hypertext linkages that link items throughout the document, which have some sort of relationship. In books this is typically handled, in part, with indexes. However, for the composition process this is useful, in a dynamic way, to set up the points in the document where the same topic is to be addressed in different ways or at different levels of detail. This means individual authors will be able to dynamically view the consistency of what they are writing by calling up associated sections while they are engaged in the drafting process.

Groups dealing with large amounts of text in a CMC system should be provided with the abilities to create and browse non-linear forms of organizing documents.

Since this is a group activity, we have the complication that individuals may not always agree on the links and the nature of the links. This is the problem of collaborative creation of Hypertext. Obviously, when many individuals are free to create links in the same body of material the functionality must be provided to aid in comparing and viewing degrees of agreement and disagreement about the structure of the material or the relationships in the concepts.

For incorporating Hypertext into the CMC environment is is desirable to utilize a general purpose semantic model that would cover the scope of how people cognitively view relationships among concepts (Rao and Turoff, 1990). If everyone is using the same concepts from which to create link and node types it becomes possible to incorporate analysis routines that would aid in uncovering patterns and exposing disagreements in complicated Hypertext web structures.

11.2 Addressing

Most CMC systems provide ways to virtually reference messages and comments within other messages and comments. The key to this is an adequate global addressing scheme for identifying an object or part of an object so that these links can be incorporated through a straightforward markup facility. It is our recommendation that any CMC system should incorporate such addressing along with the ability to specify virtual links.

If one can use a GML markup to label a segment of the text, then such an addressing scheme should be extended to provide an address for the

marked section of the item. One possible way to do this is to use a word appearing in a GML heading as a linkage term. Or, one could incorporate a more general purpose, but new, GML markup to deal with these internal linkages.

Within the context of a single CMC system, a preferred way to form a unique identifier is to start at the highest level with the id of the member who owns or created the item.

For example:

Murray.poetry.97.5

The above indicates the fifth reply to root comment 97 in the conference named "poetry" belonging to "Murray" (a unique nickname). The indicated reply could be authored by anyone in the conference.

A major criteria for addressing schemes is that the formulation of the address must be easily understood and useable by the members of the system.

11.3 Setup and Control

There is a wide range of parameters usually available to members of a CMC system. These are settings that one usually sets up and leaves alone except for special situations.

11.3.1 Interaction Mode

In many systems there are switches to shift from states such as a batch or line interface to a full screen interface. The batch type interface is useful for handling answer-ahead scripts such as massive uploading and downloading.

11.3.2 Output settings

A number of possible settings exist for controlling the format of information displayed on the screens. It is also possible that a user may need control over various window layout options. Designating the format for material to be downloaded or printed may also differ from screen formats.

11.3.3 Keyboard Definitions

In some systems there may be opportunities for the user to define certain functions keys and alternative keyboard keys to correspond to specific functions.

11.3.4 Filter Agents

Establishing software agents that will filter and organize material into reception patterns more meaningful on an individual user bases.

12. Command Functionality

While menu interfaces should be provided for any CMC system, it is important to allow the use of commands for an experienced or frequent user. The basic structure need for a CMC system would be:

	COMMAND	MODIFIER	OBJECT
Example:	View	New	Mail

The nature of the objects of a CMC system have already been covered in this document.

12.1 Commands

The best way to express the command functionality is to define the basic generic commands that should be available to members of the system to act on any object that is defined in the system. The exact meaning of the command will depend upon the type of object and the interaction state of the user.

Once the basic generic commands are defined, a member can utilize this small set of commands to accomplish most tasks. However, for experienced users it is desirable to have specific commands categorized by the generic commands which allow the user to indicate very specific functionality. Some specific versions are included in the generic set explained below.

Giving command names to functional capabilities in any interactive system allows a great deal of latitude. The words used are not as important as the commands that are performed. The following are the key generic capabilities needed to operate on objects in a CMC system.

12.1.1 View

This is a generic command for displaying any object in the system. If one calls upon a specific object (i.e. VIEW (message identification)) then it should produce the total object. If one is dealing with a list of objects like all the NEW MAIL then it should list only the "abstract" or headings of each new piece of mail and allow the member to determine which of the new items should have the total contents displayed. Examples of specific commands under the VIEW generic command could be:

12.1.1.1 List

To list a set of items giving very short, one or two line, identifications and titles for each item on the list.

12.1.1.2 Scan

To list a set of items giving the full abstract or heading of each

one.

12.1.1.3 Get

To get the entire contents for each item specified.

12.1.2 Create

To compose or contribute a new object in the CMC system. It applies to creating messages, comments, conferences, members, etc.

12.1.3 Modify

Modify is used to change an existing item, including the ability to delete it.

12.1.4 Find

Find is used to locate specific objects. The type of search options provided by the command would depend upon the type of object it is acting on.

12.1.5 Review

Review summarizes the status of the object the user is dealing with. For example, review, applied to a message would determine who has and has not received the message. Review applied to membership in a conference would indicate who has read the parts of a conference and/or who has contributed material to a given part of the conference.

12.1.6 Organize

A generic command to specify the order of items, relationships among items, or existence in a category such as "urgent" items. It could be applied to an index in a conference to allow changes to be made in which comments are associated with index keys. Many CMC systems provide the use of filters to enable the system to automatically filter out relevant material from a larger corpus of material. Other systems provide each member a specialized list of "marked" items. One of the functions under organize is the ability to mark and unmark objects to be placed in a "to do" list.

12.1.7 Do

A generic command to carry out a transaction of any type. Doing an activity is an obvious one and very different from viewing an activity. Under this generic function are capabilities such as entering a conference.

12.2 Modifiers

Within the context of a CMC system it is also important that certain modifiers be provided which can be used to distinguish among communication objects. These may be used to qualify commands. However, certain modifiers are so crucial they should automatically

be tracked as lists that are always available to members of the system:

12.2.1 New/Old

The comments, messages, notifications that the member has not yet seen. The modifier OLD would be the complement.

12.2.2 Done/Undone

This distinction applies to activities and may be used to qualify commands such as view and do.

12.2.3 Modified

Objects that have been modified since they were first created.

12.2.4 Marked

Items that a member has marked to deal with at a later time.

12.2.5 Indexed

Items that have been added to an index shared among a group of members. Such an index might exist for a document.

12.2.6 Linked

Items that have been linked to other items which the member has created or is responsible for.

12.2.7 Authored/Edited

Items which a particular member has authored or edited.

12.2.8 Public/Private

Conferences or groups that may be joined by any member of the system are considered public. The complement is private.

13. Interface Design Considerations

13.1 User Types

A CMC has to deal with three basic types of user: novices, infrequent or casual users, and expert users. As a result, the system should have a well designed menu interface, but needs to allow for the use of commands to bypass the menu choices and speed up interaction for the expert user. In addition, the interface should allow for answer ahead input so that users can devise their own macro commands to complete tasks that are frequently done with minimum effort. This is particularly beneficial for infrequent users who are not likely to spend time to master the whole system. The infrequent user can be provided with tailored commands on a group-wide basis. In other words, the group facilitator should be able to create tailored commands for the members of his or her group. For example, if a certain specific type of voting is to be used in a conference, a macro command can be created that will always take the member through all the votable items they have not yet voted on.

The ability to handle "answer-aheads" also facilities the ability to batch upload and download material to and from a CMC system.

13.2 Help Facilities

There are many collections of guidelines on what makes a system easy to learn and easy to use. It goes without saying that with the frequent change of membership that occurs with in groups and within a typical CMC system, the ease of learning has to be a major consideration. Any candidate system has to be looked at very carefully for this property. Systems that are easy to use for novices frequently suffer from being hostile to experienced users. Therefore, ease of learning is the more dominant factor. Key to this is extensive on-line help and documentation features which allow users to learn new system features when they feel the need to do so. Another key is feedback to the user for each action taken, particularly in the form of informative, English-language diagnostics, when the user makes an "error" in the form of an invalid request.

13.3 Lists

The essence of communications is that individuals have a need to deal with lists of communication items. To some extent a general CMC system structures such lists along rather obvious metaphors (e.g. new mail as a list). However, the members need the ability to form and manipulate their own lists which bring together messages, comments from different conferences, and other items. This flexibility is needed to allow members and groups to create lists that are cognitively meaningful within the context of any set of communications associated with an arbitrary task.

There are a number of ways this can be accomplished. One is to

provide a personal indexing capability so that key words and phrases can be used to collect the items associated with the term. Groups should be provided sharable indexes so members can use them to collect items from different sources of common interest to the group as a whole. Effective use of lists by experienced users implies providing a number of standard list processing capabilities so the maintenance of lists over time can be accomplished with fairly powerful operations.

It is a general observation that "list processing" is an underlying implementation model that is appropriate for a CMC environment and should be made available as part of the interface. One approach to doing this is to provide list processing options as a special menu that can be called up to apply to any list anywhere in the system. Such general options as merging, splitting, and resorting lists can be provided in this manner for the benefit of experienced users. In a system which allows an X-windows interface, the ability to deal with two or more lists simultaneously can be provided. This is particularly important for adding linking and Hypertext-like capabilities to the system in such a way that users can deal easily with the creation of links among related items.

13.3.1 Reactive Menus

When the choice of an interaction state results in a list of items a CMC system should provide a menu of specific options that can be applied to any object in the list. These options should contain the most likely commands that the user would wish to employ. As a result their would be different reaction menus tailored to the major strategy state the user has indicated. For example, the reactive menu for VIEWING items would be different from that for FINDING items. Furthermore, the choices may depend upon the type of objects in the list.

Since the system should be largely modless (i.e. any command should be executable anywhere in the system), the objective of the menu is to remind the user of the functionality available.

An example of a reactive menu is the following one that would be typical for supporting the view mode. It has the following form:

```
List/Scan  Get  Add  Compose  Reply  Do   Mark  Index  Remove
(1)        (2)  (3)  (4)      (5)    (6)  (7)   (8)    (9)
Choice/Command ? _____________________________________________
```

These reactive commands would perform the following types of tasks:

List/Scan: Normally a member is viewing a list of headers or abstracts of the objects such as messages or comments. This choice flips the list to the alternative form of the one currently being used.

Get: This will get the whole object for those indicate.

Add: This allows the member to answer certain options which

would add to the current list. For example, if the member points to a specific object, all the related items would be found.

Compose: This will allow a member to compose a new item. If dealing with a list of messages it is assume that a message is being composed.

Reply: This will allow the member to compose a reply to a message or comment, or to generate a message specifically related to the object indicated on the list.

Do: This allows the member to execute an activity, enter a conference, or other options associated with this generic command and appropriate to the object being referred to.

Mark: This allows a member to add the indicated object to their personal list of marked items.

Index: This allows a member to add objects to their personal index under appropriate keys of their choice.

Remove: This command removes items from the list the member is dealing with.

The reactive menus provide an ability to tailor a menu to the processing by a member as a function of the type of list and the interaction state of the user. It is also possible to introduce a facility that would allow the member to tailor their own reactive menus under a given label.

Since every type of activity will usually incorporate it's own specialized form of a reactive menu, the use of this approach will be consistent with the member being able to learn to deal with a wide variety of activity types by a single interaction approach.

13.4 Integration

There is no inherent reason why the same interface used to communicate with other humans cannot be used to communicate with other computer resources. With the right tools, such as a general forms system, it is possible to create interfaces within the CMC system to other computer resources as they are needed. In some cases such a facility can be used by members of the group who are expert with some sort of analysis routine or database to create simplified input screens for other members of the group. These would be tailored to the specific needs of the group.

13.5 Windowing

In the early days of handling text on computers, there was a feeling that a single screen was the primary limitation. A number of experimental systems were created using two or three separate display devices to enable the user to work on the text composition process. This was an early form of the recognition that people had to be able to view other text items while drafting a new text item. Today, this

is provided through good windowing capability. The ability to compose text, determine linkages, and to review textual material are all enhanced with windowing facilities.

In terms of the basic interface to a rich or complex system, being able to window for relative comparison among where a person came from, where they are, and where they are going, is a significant enhancement to any interface situation.

Another key use of windowing is when a user has to act in multiple roles within the context of a single activity. There are many occasions where windows can correspond to multiple roles. For example, in a group decision support situation working on a synchronous basis, a person who is acting both as a facilitator controlling the status of various activities and his or her own participation in the activity needs to be able to move quickly between the two roles.

Being able to compare simultaneously in two windows entries in a personal index with those in a group index is another example of the convenience of windowing. There are also situations where users sometimes need more than one account, to be able to operate two accounts at the same time would be a significant advantage in such situations. Therefore, it is desirable that a reasonable windowing facility be an integral part of any CMC system.

Ultimately, one of the most important applications of windowing is to tie together elements of diagrams with associated text for further clarification of the parts of a diagram. This should be one of the long term objectives of the facilities for CMC systems. This is a key area where there is not yet an emerging standard to determine how this should be handled so that all documents are compatible. Exploration of this concept should be a goal of future use of CMC to both collaboratively compose documents and to provide electronic forms of such documents for the end users.

13.6 Strategic Interactions

Experience with CMC systems indicates that there are two very different strategic interaction modes that a CMC system should support. The first is one that will serve the infrequent or casual user. These are users who do not use the system frequently enough to master it's facilities or who feel they will do only a limited type of interaction. Typically users who act as intermediaries for others will not have the motivation to master the functionality of this type of system. The second strategic mode is for the person who desires to have all the functionality available in their interaction mode and who are frequent users. This mode provides the system functionality in a more abstract and generalized manner than for the casual user.

These two approaches are illustrated in the following possible screen designs to service both types of a users. Obviously, in the implementation of such a system, the user should be able to easily flip between these two modes of interaction.

13.6.1 Casual Interaction Mode

The concept of a "casual screen" is where the casual member or infrequent user will find 95% of the things they would normally do available in a single screen and presented in a very specific manner. Each function offered is meant to be obvious.

```
CASUAL SCREEN

View:                                  number                                  number
  NEW notifications          ? y         #
  NEW mail                   ? y         #    MARKED items          ? n         #
  NEW conferences            ? y         #    UNDONE activities     ? n         #

Enter:  conference           ? n        View: any item ? n

Create: notification         ? n        message        ? n
        comment              ? n        draft          ? n

Find:   members              ? n        groups         ? n
        conferences          ? n        messages       ? n

Modify: any item             ? n        Do:  activity  ? n


Optional answer aheads and qualifications:
Member/Group(s)?                        Name/Label      ?
Message(s)     ?                        Scratchpad      ? 1
Conference(s)  ?                        Comment         ?
Modifier(s)    ?                        Keys/Categories?

Command? _____________________________
```

The Casual screen provides all the basic functions a member would undertake in a typical interactive session on the computer. It is an efficient screen for getting new material and carrying out other common operations such as composing a comment or finding another member. In this screen Y signifies Yes and N signifies No.

The Casual screen alerts the member to all the NEW objects waiting for him. These are the notifications, messages, and new comments in conferences. The screen also alerts the member to how many marked items and how many undone activities he has. The member can obtain any of these lists to work with in a reactive manner.

If the member has new items waiting the system automatically assigns a YES answer to these questions and a carriage return would immediately take the member to the lists of these new items.

The OPTIONAL fields at the bottom of the screen allow a member to answer ahead and qualify their YES answer.

The command line at the bottom of the screen allows a member to enter any valid system command. The member may also use this field to ask for help in a number of different ways.

13.6.2 Comprehensive Interaction Mode

The HOMEBASE screen is intended to be a single strategic control panel screen where a member can select any functionality and interaction state possible in the system. This is accomplished by choosing an OBJECT, MODIFIER, and ACTION from the three menus presented in this screen.

HOMEBASE SCREEN

	OBJECT	new		MODIFIER	default			ACTION
1.	Notification	###	1.	Distribution	new	###	1.	View
2.	Mail	###	2.	Reception	marked	###	2.	Find
3.	Conferences	###	3.	Parts	header		3.	Review
4.	Directory	###	4.	Types	root		4.	Create
5.	Member		5.	Status	open		5.	Modify
6.	Group		6.	Tracking	undone	###	6.	Do
7.	Controls		7.	Roles	owner		7.	Organize
8.	Systems		8.	Order	replywise		8.	Arrange
							9.	Process

Object Choice? ___ Modifier Choice? ___ Action Choice? ___

COMMAND LINE? _____

The object choice is intended to allow the member to select the type of objects he wishes to work on. The modifier choice allows a member to limit the resulting list to some appropriate subset by such modifiers as type and status. Finally, the action choice allows a member to establish what type of work he may wish to do on the resulting list of objects.

The HOMEBASE screen contains three menus for selecting an OBJECT, MODIFIER, and an ACTION. The three choices, taken together, define a

unique interaction state.

Many of the menus have sub-menus. However, a choice from the first level menu shown on the screen always results in a unique choice. The second menu, MODIFIERS, actually shows the defaults used for the first level choice. Lists of the possible submenus appear in the Appendices to this document. If a member enters a number such as "1" the default choice is taken; however, if the member enters "1." the submenu is brought up to make a more refined choice.

13.7 Control Functions

The following are the control functions that need to be provided the user of a CMC system. These should be available at any point in the interaction and probably should be mapped to the keyboard function keys.

13.7.1 Help

There should be specific help available for any screen and for any input field. The use of a "?" in an input is a typical method of getting field specific help. Also the facility to enter "?string" to find help on by using any word used in the interface is also quite desirable. A general index of "help words" should be available for browsing and it is quite natural to provide the HELP material with a Hypertext linking capability based upon the "help words" in context.

13.7.2 State Control

There should be functions for the user to indicate the following changes of state:

Go Back to the prior interaction state or screen

Go Back to the very beginning of the interaction (strategic choices)

Flip between the casual and homebase modes of interaction

Escape or Cancel the current interaction state without processing it.

Process the current interaction state without further data (accept the remaining defaults).

Quiting the system entirely.

13.7.3 Screen Control

Besides the normal functions of moving back and forth between a series of screens, it is important when dealing with text to be able to either scroll or move a half screen at a time, or both.

Control also needs to be provided for moving backward or forward in a series of data input fields. Clearly the TAB, SHIFT-TAB, and CR keys are used for this.

13.7.4 Confirm

This is a function that is very critical to a CMC system. It requests the system to verify and confirm the input data and display the results to the user before processing the current interaction state. For example, individuals will be using short identifications to indicate addressess or items that desired. The confirm function would display the complete name or title for an item and allow the user to view if they had indicated the right short form before actually processing a state such as sending a message.

13.7.5 Print or File

The member should be able to indicate that the object or screen they are dealing with is to go to a file that may later be printed. They should also be able to turn on and off the moving of material to this file as they are moving from screen to screen. the resulting file may be used for printing and/or creation of a separate file.

Being able to distinguish between types of files (e.g. binary or ASCII) and create a sequence of files to be manipulate for creation of a floppy is also important.

13.7.6 Transferring

The ability to easily upload and download, or in essence call for the transfer of files between the workstation and the system is also desirable for setting up as a set of controls.

14. Summary

14.1 Evolution

This document has defined a lengthy set of functional requirements desirable for a comprehensive CMC System. It goes without saying that there is no single system in existence today that offers this complete range of functionality. It key is to focus on systems that provide the ability to easily tailor and modify features, so that many of these capabilities can be evolved over time according to the needs of particular organizations and applications. The underlying implementation of a CMC system, the degree to which features can easily be added, and the degree to which it can be integrated with other computer resources, are important considerations.

14.2 Network Integration

An additional concern is the realization that applications of CMC involves a potentially large user population. The ideal CMC system is one that can support a very large user population by being able to operate in a distributed network of computer systems.

A final consideration is that the system should allow the utilization of appropriate data standards for all the multi-media material it is handling. It must also interconnect with numerous mail and message systems that already exist on a national and international basis.

14.3 Metaphor Summary

The particular metaphor we have presented for the desirable structure of CMC systems can be summarized as follows:

- Directory
  - Members and Roles
  - Groups
  - Conferences
  - Systems and Contacts
  - Interest and Topic Keys
- Members
  - Memberships and Roles
  - Personal Index
  - Specialized Lists
    - Notifications File
    - Marked Items
    - Authored Items
    - Undone Activities
    - Created Activities
    - Tickets given and recieved
- Groups
  - Membership and Roles
  - Shared Indexes and Lists
  - Group Conferences
  - Group Mail
- Notifications
  - System Generated
  - Canned
  - Composed
- Mail
  - Index
- Conferences
  - Membership and Roles
  - Index
- Comment and Message Structure
  - Replies
  - Activities
    - Membership
    - Responses
    - Triggered Notifications
  - Attachments
    - Binary files
    - Graphics
  - Appendages
    - Delta Edits and Marginal Notes
    - Canned Notifications

14.4 Ethics and Policies

The operators of a CMC system should make clear to all the members what the ethical policies are under which the system is operating. The following is a recommended set based upon what would be a service operation. A system operated with in a single organization might have tighter restrictions than those suggested here.

In general the problems of ethical behavior should not be used to limit the provisions of functions (e.g. copy) that might lead to abuses. Since material can always be transfered to a personal computer and other methods imployed, limitations on functionality make no sense. Ethical behavior can be encouraged by promoting social awareness of what is considered ethical behavior for the group and/or the system. However, ethical behavior can be enhanced by providing communication enhancements. For example, people can be notified if someone has made a copy of their message or comment.

14.4.1 Ownership

It should be that the material authored by an individual should be considered to be his or her property. This should be the general policy under which the system is operated. However, the owner of a conference does have power over the material placed in his or her conference. It should be the obligation of the owner of a conference to state the ownership policy for items entered in the conference.

In general the system operators and conference owners should recognize a "copyright" when ever it is placed upon an item. The general atomosphere on networks is that items of interest are often transfered around by individuals other than the author. In general it should be stated policy that this is possible for anything entered in a "public" conference. For private conferences there should be a policy determined by either the owener or by a meta dicsussion among the group participating.

14.4.2 Anonimity, Pen-Names, and Censorship

The system knows internally who the real author is of a comment or message that was signed anonynously or with a pen-name. Members should be informed of under what conditions a request would be made of the systems people to determine who the real author is. Certainly a court order for such an exposure would have to be honored. Short of that the typical instances under which this is done is the entry of pronographic material in public conference, threats made to individuals, criminal actions (e.g. providing credit card numbers), and in some cases slander. In many of these situations, particularly when private messages are used, there has to be a member who is a complainent or victum of the material.

It is perfectly proper to have private conference that may be devoted to material such as dirty jokes. In that case it is the obligation of the owner to inform adults of the nature of the conference they

wish to become a member of and to deni membership to young children.

The owner of a conference does have deletion privileges over any material entered and it is accepted policy that he or she can delete material that is off the subject or out of place in that particular conference. The author would be sent a notification automatically when such a deletion occurs. Also, it is convient to provide conference moderators with a more powerful function which both deletes and copies the material back to the author in a private message.

14.4.3 Deletion

The question of deletion becomes more complicated when items that may be deleted are part of a linked network of items because a group of people have collectively gathered the material. Someone deleting an item of text could break apart the coherency of a set of of items that are inter-related. For this reason, the system should provide a "proposed deletion" state which would notify people that a deletion of an item linked to some of their material is about to occur. This would provide an opportunity to take approp(riate corrective action.

14.4.4 Sanctions

It is always possible to remove a member from a private conference or from the system if they do no)it conform to the accepted behavior on that system. However, the more acceptable way of encouraging better behavior is to be able to place the member in a "read-only" status with respect to a conference or on a system wide bases.)iThis has frequently been used in educational environments with students to bring their behavior into line. It is also possible to introduce system features like having mail from a certain individual reject and notifying the individual that it is being rejected. This is very useful for individuals who do not want unsolicited mail from a given source or who already feel bothered by the occurance of such messages.

15. APPENDIX

The following three appendix items provide a comprehensive listing of the underlying structures for OBJECTS, MODIFIERS, and COMMANDS. These may be viewed as exhibiting a two level menu structure along each of the three dimensions.

The final appendix is a reference list of documents from which material was in part gathered for this document.

15.1 Object Structures

OBJECT	EXPLANATION
1. Notifications	Short one/two line notices
1.1 Notes	From member to member
1.2 Reactions	About an item, canned or written
1.3 Requests	Something needs doing
1.4 Establishments	Membership changes, etc.
1.5 Informational	Alerts, reminders, etc.
1.6 Transactions	Generated by actions
1.7 Activities	Generate by activities
2. Mail	Among members and groups
2.1 Receivers	Of mail
2.2 Index	Of message keys
2.3 Categories	Filtered by categories
2.4 Messages	Entries in mail file
2.5 Activities	Linked to messages
2.6 Notifications	Dealing with messages
3. Conferences	Discussion transcripts
3.1 Membership	List for a conference
3.2 Index	Conference index
3.3 Categories	Filters for Conferences
3.4 Comments	Comment List
3.5 Activities	Focus on activity
3.6 Notifications	For a given Conference
3.7 Structure	Conference structure
4. Directory	System wide
4.1 Members	Focus on members
4.2 Groups	Focus on groups
4.3 Conferences	Focus on conferences
4.4 Interests	Member and mail address keys
4.5 Topics	Group and conference topic keys
4.6 Contacts	External Addresses
5. Member	Member's personal information
5.1 Membership/Roles	Members list
5.2 Index	Members personal index
5.3 Marked List	Member's marked items
5.4 Drafts	Temporary scratchpad use
5.5 Activities	Global activities list
5.6 Authored List	Member's authored items
5.7 Conferences	Member's conference list
5.8 Tickets	Exception privilege passing
6. Group	Super member
6.1 Membership	Membership and roles in group
6.2 Index	Shared group index
6.3 Marked List	Shared marked items
6.4 Mail	Group message list
6.5 Activities	Group activities list

6.6	Notifications	Group notifications list
6.7	Conferences	Group Conferences
6.8	Tickets	Group ticket list
7.	Controls	Control & setup options
7.1	Filters	Category selection
7.2	Commands	Command setup
7.3	Utilities	Special functions
7.4	Interaction modes	Setup selections
7.5	Terminal options	Setup selections
7.6	System options	Global system features
7.7	Format options	Material layout
8.	Special Systems	Future extensions

15.2 Modifier Structures

MODIFIER		EXPLANATION
1.	Distribution	System type modifiers
1.1	New/Waiting	Items not yet viewed
1.2	Old/Accepted	Items already received
1.3	Private	For a specific member
1.4	Group	For a specific group
1.5	Public	For any member
1.6	Interest	Member keys
1.7	Topic	Conference/Group keys
1.8	External	From/To external systems
2.	Reception	Member controlled categories
2.1	Marked	Items marked by receiver
2.2	Indexed	On an index
2.3	Categorized	Use of filters
2.4	Related	Reply type relationship
2.5	Associated	Common keys
3.	Parts	Parts of items
3.1	Abstract	Full item abstract
3.2	Header	One/two line short form
3.3	Keys	Item keys only
3.4	Content	Text or contents of item
3.5	Roles	Roles associated with item
3.6	Appendage	e.g. added notifications
3.7	Attachment	Attached files
3.8	Activity	Linked Activity
3.9	Form	Forms associated with items
4.	Types	Types of items
4.1	Root	Only root items
4.2	Reply	Only reply items
4.3	Appendages	Items added to contents
4.4	Attachmeents	Passive major additions
4.5	Activity	Only items with activities
4.6	Response	Activity responses
5.	Status	Of objects
5.1	Open	Maybe used
5.2	Frozen	No changes allowed
5.3	Closed	Cannot be used
5.4	Sequenced	Another item required first
5.5	Required	Must be done
5.6	Optional	Need not be done
6.	Tracking	Member to Object status
6.1	Undone	Not done yet
6.2	Incomplete	Partially done
6.3	Undetermined	Cannot be tracked
6.4	Done	Finished transaction
6.5	Skipped	Will not be done

7.	Roles	Object associated roles
	7.1 Creation	Ownership or Authorship
	7.2 Membership	Normal role for object
	7.3 Privileged	Allowed to change things
	7.4 Restricted	Less than member privileges
	7.5 Structured	Tailored to task
8.	Order	item list sequence
	8.1 Replywise	ordered by reply structure
	8.2 Timewise	Ordered in time
	8.3 Relationship	Association, links, etc.
	8.4 Alphabetically	keys, authors, status
	8.5 Numerically	Id's, counts, data

15.3 Command Structures

COMMANDS	EXPLANATION
1. View	Look at items in list
1.1 List	Headers only
1.2 Scan	Abstracts only
1.3 Get	Whole item
1.4 Filter	Use category keys
1.5 Keep	Keep in list
1.6 Accept	Receive without viewing
1.7 Inhibit	filter additional items
1.8 Skip/Zip	Skip remainder of object
2. Find (by)	Search options
2.1 Keys/Labels/Names	By string matches
2.2 Status	By object status
2.3 Type	By item type
2.4 Date/time	By creation or modification
2.5 Roles	By roles for items or entities
2.6 Relation	By relationships
3. Review (by)	Tabular type summaries
3.1 Index	Use of keys
3.2 Status	By item or entity status
3.3 Distribution	Activity distributions
3.4 Date-Time	By occurrence
3.5 Membership	By member activity
3.6 Structure	Settings, protocols, etc.
4. Create	New entries/additions
4.1 Reply	To existing item
4.2 Draft	Work with scratchpads only
4.3 Notify	Generate notification
4.4 Append/Add	Append to an item
4.5 Attach	Attach a file
4.6 Activate	Create activity
4.7 Link	Link two objects
5. Modify	Change existing items
5.1 Edit	Text and content
5.2 Alter	Abstracts, tickets, etc.
5.3 Update	Modify data
5.4 Change	Parameters, status, etc.
5.5 Assign	Roles, membership
5.6 Delete	Remove items from system
5.7 Restore	Bring back deletions
5.8 Burn	Unrecoverable deletions
6. Do	Activities, lists, tickets
6.1 Use	ticket, group index, etc.
6.2 Enter	Conference, special system
6.3 Join/Unjoin	Change membership
6.4 Act	In role

6.5	Read	Documents
6.6	Respond	To Activity
6.7	Fill	Fill in form
6.8	Select/Vote	Make choice
6.9	Execute	Program
7.	Organize	Arrange, restructure, etc.
7.1	Index/Unindex	Add item to index
7.2	Mark/Unmark	Add item to marked list
7.3	Add/Insert	Add to list
7.4	Remove	Remove from list
7.5	Merge/Combine	Two lists into one
7.6	Move	Relocate an object
7.7	Copy	Make copy of object
7.9	Reorder	Reorder list
8.	Setup	Housekeeping functions
8.1	Set	Set parameters
8.2	Print	Setup print functions
8.3	Connect	Connect to other system
8.4	Transfer	Transfer between system
8.5	Utilize	Other facilities
8.6	Transfer	Transfer between systems
8.7	Connect	Connect to system or program
8.8	Utilize	System or program
9.	Process	Control of processes and agents
9.1	Start	Start a process
9.2	Pause	Suspend a process
9.3	Examine	Look at status of process
9.4	Cancel	Terminate a process
9.5	Restart	Restart a paused process

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Initial Choice?