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ABSTRACT

This document is the X3J11 response to CBEMA's Request for Information (RFI), dated 1994-06-06. This document analyzes the CBEMA RFI with respect to existing systems, procedures, and experience.

1. REQUIREMENTS

This section reviews the requirements of the RFI. The ordering of this section parallels the ordering of requirements in the RFI. In some cases, the same requirement has been stated several times in the RFI, each time with a different emphasis. This section includes the requirement each time it is mentioned in the RFI so that the reader of the RFI and this document are assured that all requirements were addressed in this response.

Each requirement is stated (under the "Requirements" heading), abstracted, and analyzed (under the "Analysis" heading). The analysis is the basis for the architecture of the system (the next section).

1.1 Work Process

1.1.1 Documents

Requirements

The work of committees involves the following tasks:

- Document collaboration. Several people can exchange ideas or work on portions of a document separately or together.
- Creation. A new document is created that CBEMA tracks with some identification tag.
- Alteration. An existing document is modified by people that are authorized to do so.
- Storage. CBEMA stores a copy of the document on its server.
- Maintenance. Backups, restores, and archives are performed, as necessary.
- Distribution. A copy of the document is delivered to the desired recipients on the media they desire.

Analysis

Document synthesis will be performed by the editing committee. Prior to creation (registration) at CBEMA, the editing committee may use any convenient means (e.g., E-mail, sending floppies, FTP) for collaborating. Once registered at CBEMA, the editing committee may use any of the access methods (described below) to collaborate.

The creation (registration) of a document on the CBEMA system does not imply completion of the document — quite the contrary. The creation of a document implies that changes will be controlled (tracked) and distribution will be managed during the completion of the document by the editing committee.

A version control system (e.g., SCCS, RCS, CVS) is used to track each change to the document, the person making the change, and the reason for the change. As the document approaches completion, the editor can change the parameters of the version control system to enforce mapping of document changes to previously registered change

requests. In other words, even if you are part of the editing committee, you can't make a change to the document unless there is an authorization to make a change. The change requests can be generated by comments from public review or defect reports.

Changes to the document are synchronized by a "check-out/check-in" paradigm. When a person wants to make a change to a document, they must check-out the document for editing. Until the revised document is checked in, no other person may make changes to the document. This method eliminates two people modifying the document at the same time. At all times, any authorized user may get a read-only copy of the document.

There are other paradigms for supporting multiple users editing a document, e.g., copy/merge paradigm, or multi-user editors. However, for novice users, these methods create more problems with document editing than the time they are intended to save. The only recommended paradigm is "check-out/check-in".

Additionally, the version control system is capable of:

- Identifying changes between any versions (red-lining).
- Extracting any prior release.
- Backing out changes.

1.1.2 People

Requirements

- Single document editor controls (write) access.
- Many members need to read document.
- Members need to submit change requests (edits) to the document editor.

Analysis

In practice, several people edit a standing document. Typically, the editing committee distributes the work load, yet one person has final authority over the editing of the document. What is needed to two levels of access administration:

1. The top level is controlled by CBEMA. CBEMA provides the editor with read/write access to the standing document.
2. The second level is controlled by the editor. The project editor may grant read-only and/or read/write access to other members of the committee.

Transient documents come in two varieties: official and unofficial committee documents. Official documents are registered with a document number. CBEMA should allow only its staff or committee officials to create transient documents. Committee officials may grant other committee members access to the document. Unofficial documents are not tracked, i.e., not registered and not part of the version control system.

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The version control system manages user access capabilities and synchronizes changes. See the description above for a list of features of the version control system.

1.1.3 CBEMA Perspective

Requirements

- Collaborately generate electronic document.
- Version control.
- Document assignment and logging by secretariat.
- Mass distribution: download, floppies, CD's, and/or paper.
- Balloting (secure and timely).
- Release control.

Analysis

CBEMA needs a system to support its members, coordinate document receipt and distribution, and reduce the manual paperwork involved as the X3 Secretariat. Document creation, control, and assignment are mentioned above. Document distribution and balloting are mentioned below.

Release control is version control at a higher level. For example, consider a project that has four separate documents: front matter, main sections, appendix, and rationale. Each section is maintained by a separate editor. When the document is released for public review, the following components comprise the document (all version numbers were assigned by the version control system):

Release Name: Public Review #3, Dated 1994-07-01
Front Matter, version 1.7
Main Sections, version 1.215
Appendix, version 1.34
Rationale, version 1.127

This information describes a "release" (a release control file) of the document. This information itself it maintained in a file that is under the version control system. If, many years in the future, the committee wishes to extract a copy of this (now old) release, all that is necessary is to extract the correct version of the release control file. Once the old version of the release control file is extracted, the release control file is supplied to the version control system to extract all the old versions of the components that were associated with that release.

The use of multiple levels of version control (a version control hierarchy) for release control can be extended to any level, as necessary. Some version control systems implement release control, too.

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1.2 Access Capabilities In Five Years

Requirements

All users will have access to:

- E-mail. All users will have access to some form of E-mail.
- BBS. All users will have access to some local BBS with direct Internet access.
- Documents. Documents will be distributed in a common format.
- Files. A documents will be accessible.
- Balloting. Balloting will be done electronically.

Analysis

Bulletin Board Systems (BBS) and on-line services will go through many changes. In five years, the price/performance of POSIX systems will be well beneath the cost of specialized network routers and data switches (they are approximately the same price now). Using a POSIX system locally rather than routing all services back to a central server will provide several benefits:

- Performance. Much work can be off-loaded from the central servers.
- Routing. Rather than a hierarchical routing back to central servers, more efficient peer-to-peer routing can be performed. Since the routing topologies are more efficient, network performance and reliability will be improved.
- Value-added services. If there is more money to be made, surely people will. Access to local POSIX services may command a premium in contrast to specialized, centralized services.
- Cost. Since POSIX systems will cost less and, possibly, provide more revenue, the reduction of cost will be a significant motivation.

Currently, several smaller on-line services provide local access to general services (e.g., TELNET, E-mail, FTP, POSIX commands). In five years, the major on-line services (e.g., Compuserve, Prodigy, America On Line) are likely to provide local access to more features.

In five years, documents will all be in a common format: ISO SGML. Most of the word processing vendors have announced that they will support SGML as a file format. This means that you can use your favorite word processing package (e.g., Microsoft Word, Wordperfect, etc.), but all share the same files. In the future, word processing packages will be competing for the best usability, support quality, features, and price (unlike now where they compete for market share in storing documents in their native format). However, all the major word processors will be able to exchange files in SGML format. Additionally, the SGML format is suitable for storing spreadsheets and databases, so the spreadsheet applications (e.g., Lotus 1-2-3, Microsoft Excel) and the database applications are likely to use SGML and another interchange format.

All users will have access to some E-mail system that is accessible directly or indirectly from the Internet, i.e., all users will have some Internet-style E-mail address. Electronic balloting will be performed as a service layered on top of existing E-mail services. Currently, several committees (including X3J11) are experimenting with electronic balloting.

1.3 Document Services

Requirements

- Balloting. The balloting may be based upon document.
- Document access. Users will have access to the document.
- Search capability (full text). Documents will be available for searching. The result of the search should return the actual words (full text) within the document.
- Indexing (keyword). Documents will provide useful indexes and keywords for subsequent searching.
- Distribution lists. Sending to a single address causes all the people on the list to receive the message.
- Consolidated mailing lists. The database of address information (E-mail address, postal address, fax number, telephone, etc.) must be consolidated into a single database.
- Bulletin board system. BBS to share free flow of ideas.

Analysis

Users will be able to review documents and return their comments via E-mail *with the relevant portions of the document embedded in the E-mail.* In previous attempts to send documents out electronically for review, the general problem was that the Postscript file, although easy to display and print on most systems, couldn't be used for extracting the text to edit and/or return with comments. Thus, users were forced to print the document and retype all the original text in their comments. Some systems do have the capability to extract text from Postscript, but they aren't as widespread.

The easier solution is to distribute the SGML version with the Postscript file ("distribute" means make available — see document distribution below). Since much of the SGML file is plain text with the occasional embedded SGML command (e.g., <p> embedded means "beginning of paragraph"), reviewers can easily locate the original text, possibly provide modifications, and send it back via E-mail. **Virtually every text editor on every system provides this capability.** Of course, some users may decide to use sophisticated tools (which they may use), but the technique of making both the Postscript and SGML formats available is simple and general enough for all users. In X3J11, the use of some text-like format is preferred for reviewing documents (e.g., minutes, defect reports) rather than sending only a Postscript file.

On-line searching is highly desirable. Several tools are available to do this. A character-based interface (e.g., a VT100 terminal or a printing terminal with a capture

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log) accessible via dial-in or TELNET would have a higher degree of usability rather than a graphics based interface. Most on-line services in the legal community (which have many more users) use a character-based interface. CBEMA's full text search service should be modeled after the services of the legal community.

Keyword indexing and searching has been refined in related areas: the IEEE and ACM organizations. CBEMA should use their methods and procedures.

A database of consolidated contact information (E-mail address, fax, telephone, postal address) is useful for maintaining CBEMA's membership database. As long as the database utility has some capability to export to text, simple scripts can be written on the POSIX system to extract the information and update the information for electronic distribution. Thus, changing an entry database could automatically cause the changes to be made elsewhere.

Document distribution and BBS's are discussed elsewhere in this document.

1.4 Administration

Requirements

- Fileserver access report.
- On-line purchase of documents.

Analysis

On most POSIX systems, a detailed accounting logs and chargeback tools are available. The following is a sampling of usage logs available:

- Dial-in sessions.
- TELNET sessions.
- FTP sessions.
- UUCP transactions.
- E-mail transactions (minor scripting is required).
- Individual command usage.
- Outgoing fax usage (minor scripting is required).
- Outgoing paper usage (minor scripting is required).

It is possible to organize the purchasing of documents by extracting the relevant entries from the FTP logs and sending out bills. However, this isn't likely to be friendly for users that *accidently* ship the wrong document. Furthermore, copyright issues need to be resolved.

The simplest solution is to leave the complex issues (e.g., copyright and billing account establishment) to human interaction and the easy problems (e.g., methods and media of delivery) to automated means. All potential buyers should sign a contract (paper) with CBEMA that authorizes the electronic access method and acknowledges

the important billing and copyright issues. To speed up the process, a copy of the contract may be retrieved via FTP access and faxed to CBEMA. AT&T (and later UNIX System Laboratories) has used this method (paper contracts, electronic transfer) successfully to distribute their programmers' toolkit software (e.g., Korn shell, CSCOPE).

The use of digital signatures and other "high" technology is overkill. A digital signature requires establishment of a key. Obviously, its easier to FTP and fax a contract then to establish an authentication scheme (e.g., sending a key) over networks susceptible to snooping.

BBS's are not suitable for purchasing documents since the contractual issues are not assured. BBS's are mostly useful for distributing free software without any obligations.

Finally, the pricing of documents needs serious consideration. Currently, most documents available on the Internet are available for the cost of the connection (i.e., not $70 for a copy of a standard). Users are not likely to pay more than the cost of photocopying when purchasing an electronic document (e.g., around $10-15). Two points are worth noting with respect to the C Language Standard:

- It is cheaper (i.e., free) to get the source code for several good ISO/ANSI C compilers on the Internet now, yet it costs about $70 to purchase a copy of the C Standard from ANSI. ANSI sets the price of the document, not X3J11.
- Because ANSI's price is so high, many X3J11 members now purchase the book *The Annotated ANSI C Standard* for $35. It is not because the book is better (it's not, there are mistakes in its discussion of ANSI C), but because the book contains a photocopy of the C Standard.

Finally, it is not likely that ANSI would allow CBEMA to resell documents unless CBEMA raised the prices even further. The reason is that ANSI is overly dependent upon its book sales to support and subsidize its operations (read: book sales generate an enormous profit in comparison to their cost). If you're not convinced of this, then answer the question: How is it possible that a publisher in the private sector is able to make a profit that included the C Standard **and** adds the value of annotation **and** pays the author all for $35? Until ANSI adjusts to the electronic age, it is unlikely it will allow any of its secretariats to divert income from ANSI.

In summary, there are three conflicting directions. The consumer is willing to pay some amount between free and the cost of photocopying. The producer wants to keep the price high to subsidize its other operations. The author (the committees) **who don't get paid for doing this work** can shop around the the best deal, e.g., IEEE, ANSI, ISO, UN, or even sponsorship by national bodies outside the US (Canada or UK).

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1.5 Scheduling

Requirements

- Manage meeting schedules.
- Manage external deadlines.
- Staff resources.
- Meeting rooms.

Analysis

There are two scheduling issues: within CBEMA (internal) and among the committees (external). Internal scheduling (like any office) may have many slots to schedule, many changes, and fine granularity. External scheduling (for committees) may be handled with a pencil and a paper calendar. See the section on scheduling below.

X3J11 has little experience to share in resolving scheduling issues since its meeting dates and locations are planned 2-3 years in advance. For the past 10 years, there have been no scheduling conflicts. Planning 2-3 years in advance may not be practical for some committees.

1.6 Mail Service

Requirements

- Allows committees to share information.
- Staff conveying (CBEMA) management issues.
- Distribution groups created.
- Some groups need secure E-mail access.
- No assumptions made about mode of delivery.
- Not viable to require members to "sign up" for a service.
- Internet FTP access is required.

Analysis

Mail services are discussed elsewhere in this document. Members don't have to sign up for any service — they still can pay for dupication costs for paper media.

1.7 File Server

Requirements

- Intelligent, rolling two years, aged by month, on-line access.
- Full text word search.
- Unique identifier.

- Automatic backup system — daily backup.
- Database restoration in hours not days.
- Monthly archives retained indefinitely.

Analysis

These issues have been discussed elsewhere in this document.

1.8 Access/Media

1.8.1 Management Items

Requirements

- Go out via E-mail.
- Fax sent if no E-mail.
- Postal distribution otherwise.

These issues have been discussed elsewhere in this document.

Analysis

1.8.2 Internet Node

Requirements

- Support direct link.
- Dial-up.
- FTP access.
- Support browsing.

These issues have been discussed elsewhere in this document.

Analysis

1.9 Document Formats

Requirements

- Documents created by commercial "shrink-wrapped" applications.
- Documents need to annotated, searched, amended, and distributed.
- Need to be displayed in native word processing format.

Analysis

These features have been discussed above in the "Documents" subsection and below in "Electronic Documents" subsection.

2. ARCHITECTURE

The methodology used in this architecture parallels the code development cycle in many software engineering shops. Software development and standards development have much in common in their methods. Stated abstractly, both development methods:

- Allow many people to work with electronic objects.
- Make reliable, manageable progress based upon further refinement (software: analysis, design, coding; standards: conceptual model, semantics, bindings).
- Allow development to occur wide geographic areas.
- Support multiple releases (software: alpha, beta, and final releases; standards: current draft, draft standard, standard).
- Support feedback and quality mechanisms (software: bug reports, enhancements; standards: defect reports, public comments).
- Support the customer (software: customer support; standards: requests for interpretation).
- Support life-cycle maintenance (software: maintenance releases; standards: technical corrigenda).

Certainly, it's possible to get carried away with this analogy. The point is, however, there is much in common. Since software development methodology is well known **and applicable** to standards development, it would help greatly in the training of users if the paradigm CBEMA used was one that the uses were familiar with. Additionally, since these methods have been refined over decades, there is less risk in choosing a "tried and true" method.

2.1 Constraints

This proposal is modest in that it acknowledges the following important constraints:

- CBEMA has limited staff to create and support this system.
- CBEMA has limited funds.
- CBEMA cannot divert revenue from ANSI, e.g., selling copies of standards would be a loss of significant revenue for ANSI.
- CBEMA and its X3 members are volunteers.
- CBEMA is not in the computer services business. CBEMA uses (and may provide) computer services because it facilitates its role as X3 Secretariat.
- CBEMA must compete will other organizations for service quality, e.g., other ANSI Secretariats, IEEE, ACM, CCITT, and private consortiums and organizations.

2.2 Electronic Communication

2.2.1 Differing Methods Of Sending

Users have one or more methods for receiving messages from CBEMA (messages may be documents, letters, ballots, etc.):

1. Postal mail. Messages can be delivered by postal service. The messages may be on paper, magnetic, or optical media.
2. Electronic mail. Messages are delivered as E-mail via routing systems. E-mail may be delivered, for example, via UUCP (point-to-point store and forward), SMTP (Internet direct connection), SENDMAIL (Internet store and forward), NEWS (Network News, a forum protocol), proprietary E-mail systems (e.g., CC:mail), proprietary forum systems (e.g., Lotus Notes), or any combination above.
3. Facsimile. Messages are delivered via fax protocol. Most fax systems deliver images via fax protocol, however, future enhancements to the fax protocol (CCITT T.131) will allow the transfer of electronic documents.
4. Telephone. Small messages may be delivered via telephone. The telephone may be used for conferences of small groups.
5. Internet access. Messages are delivered via IP network layer protocol, either TCP or UDP transport layer protocols, and one of many public (TELNET, RLOGIN, TALK, FTP, SMTP, MIME, NEWS, X, NFS, etc.) and private session layer protocols. The session (and above) layers implement the functionality of service.

Users have any combination of direct, transient, or indirect Internet access, E-mail, fax, telephone, and/or postal mail. The utility SENDMAIL can be configured so that sending to an E-mail address can cause a telex (e.g., Easylink or MCI mail), a fax (assuming a fax modem or using MCI mail), or a postal letter to be generated (printed and batched each day). Even postal mail can be sent electronically (e.g., Easylink electronic letter service).

The primary feature of using utilities like SENDMAIL is that they make the delivery method transparent.

2.2.2 Differing Methods Of Receiving

Both committee members and the public have several methods of sending messages to CBEMA. Messages can arrive via paper, floppy diskette, (magnetic, cartridge, 8mm, DAT) tape, E-mail, telephone, fax, UUCP, or FTP. When CBEMA *sends* messages, the choice of media isn't as important because almost all methods can be automated. However, when CBEMA *receives* messages, the choice of media can range from labor intensive to completely automated.

1. Paper. Paper requires the most handling and, therefore, the most labor. Furthermore, if all paper documents had to be scanned to render and electronic image,

the labor would increase. A scanned image could be displayed on systems that supported graphics (not all users have access to this type of equipment), but the scanned image could not be manipulated for content since the text would appear just as graphics. To make the image more useful, the document would need to be processed by optical scanning recognition (OCR) software that translated the graphics into text. OCR software is not perfect so all documents would beed proofing for typos and incorrect conversions. Both scanning and OCR would be extremely labor intensive.

2. Floppy. Two formats should be supported: MS-DOS backup format and POSIX CPIO format. Both formats handle files that spand multiple volumes.
3. Tape. Several tape media need to be supported. Both POSIX CPIO format and ANSI tape labels (X3.27) should be supported.
4. Electronic mail. E-mail requires 7-bit ASCII text format. The public domain utilties UUENCODE and UUDECODE support this.
5. Facsimile. CBEMA should not encourage the receipt of faxes, except for contracts for electronic purchasing of documents. Receiving faxes requires the same amount of work as receiving paper. If CBEMA converts faxes to other electronic forms, e.g., convert to text via OCR, much more effort is involved.
6. Telephone. The telephone should only be used for very short, brief messages, e.g., requesting meeting schedules.
7. FTP. Although this *could* be promising, it may require a fair amount of system administration support (creating a login for each FTP guest). Receiving files via anonymous FTP creates too much work. Users should use E-mail or UUCP instead.
8. UUCP. The CBEMA system could support anonymous dial-in of UUCP. The only extra system administration work would be verifying that the file system quotas haven't been exceeded.

2.2.3 Mailing Lists

The easiest method for facilitating discussion is to maintain mailing lists (E-mail reflectors) that send copies to everyone. For example, `x3j11@cbema.org` might be the reflector (mailing list) that sent E-mail to all X3J11 members. In this case, all recipients are required to have E-mail since the intent is to have short, quick, responsive discussion. The `x3j11` reflector is used for "water cooler" discussion, i.e., none of it is official. The following is a complete list of proposed reflectors for X3J11:

— `x3j11@cbema.org` — All X3J11 members that have E-mail access. Primarily for E-mail discussion.

— `x3j11-all@cbema.org` — All X3J11 members: primary, alternates, observers.

— `x3j11-primary@cbema.org` — Only X3j11 primary members.

— `x3j11-alternate@cbema.org` — Only X3J11 alternates.

— `x3j11-observer@cbema.org` — Only X3J11 observers.

— `x3j11-voting@cbema.org` — Only voting members.

— `x3j11-letter-ballot@cbema.org` — Letter ballot.

Names could have been in the style `primary@x3j11.cbema.org` (style 2) rather than `x3j11-primary@cbema.org` (style 1). The problem is that the style-2 name might not be a machine that CBEMA has control over, e.g., X3J11 might maintain its own machines. CBEMA would have to forward all changes to the membership list, as requests, to the owner of the machine. Since membership maintenance is CBEMA's responsibility (and not the committees'), the style-1 names should be used.

2.2.4 Secure Mail Access

Mailing lists can be controlled by who can submit to them, especially lists that would cause faxes (cost) or postal mail to be sent (cost). Additionally, some mailing lists would need control for security reasons, e.g., only the committee chair could submit to `x3j11-ballot`. There are several authentication schemes that provide security transactions like these. All these capabilities are available by configuring SENDMAIL (the mail routing utility) and minor scripting (e.g., calling `grep`) on most POSIX systems.

2.2.5 Telephone Conferencing

Telephone conferencing has been used for small discussions of 3-10 people. Telephone conferencing is attractive because its cost maybe less than people traveling. Almost every long distance carrier supports this service. CBEMA does not need to facilitate this type of discussion since members can arrange for it themselves.

2.2.6 Balloting

Balloting can be partially automated. For members that can only receive fax or postal mail, the (automatically generated) paper ballots will still be used. The paper ballots must be counted manually.

For members with E-mail addresses, the following four step automated process can be used:

1. CBEMA sends a copy of the E-mail ballot to the members accessible via E-mail.
2. The members respond with a copy of the ballot, their vote, and any comments.
3. A confirmation ballot is sent back to the member that includes an automatically generated random number. This authentication step reduces the possibility of forging E-mail addressed to pretend they are the member.
4. The members agrees and responds to the confirmation.

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Again, this process can be implemented with minor scripting and configuration of SENDMAIL. After the deadline, the electronic ballots are tallied. The manual tally is incorporated into the result. CBEMA returns the tally and its comments to the committee.

X3J11 will be experimenting with this type of mechanism for straw votes.

2.2.7 Multimedia Encoding

The Internet MIME protocol, layered on top of E-mail, is in use for sending multimedia documents. Few members have graphics, speakers, and microphones attached their systems. Given that few members have this capability, CBEMA need not spend effort coordinating activity. Even so, MIME is a layer on top of E-mail, so CBEMA might *never* have to do anything, i.e., the members that want to use it can if they can support it.

2.2.8 Multimedia Conferencing

This may involve:

- Video conferencing. Each member can see, hear, and talk to each other.
- Telephone conferencing with drawing boards. A telephone conference is combined with a an electronic drawing board that everyone shares. Several shared drawing board mechanisms are available (computer screen with network broadcast, whiteboard with "copy" feature, etc.).

CBEMA should make no efforts for multimedia conferencing until: there is demand for it, standards and protocols have been established, the users can support it.

2.2.9 Summary of Communication Methods

When choosing a protocol or combination of protocols and services for sending and receiving messages, the choice is mostly dependent on the following characteristics.

Functionality

The sender(s) and receiver(s) of the message choose the functionality that meets their requirements. For example, there is a wide range of Internet services, as described by Internet RFC's (Request for Comments), the meet most needs for messaging.

Compatibility

A widely available public protocol (e.g., SMTP — the E-mail protocol) will allow a large number of people to participate. A not so universal public protocol (e.g., NEWS — the network forum protocol created by USENET) might have better functionality, yet allow fewer people to participate. Of course, a custom private protocol might have the best functionality with the fewest participants.

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Fallback Via Layering And Encapsulation

In some cases, the participant may use conversion utilities (e.g., most proprietary E-mail systems provide an SMTP gateway), connectivity features (e.g., UUCP can be used between two disconnected parts of the the Internet to to exchange E-mail, transfer files, or execute commands remotely), and/or encapsulation (e.g., IP packets can be "tunneled" in IBM's SNA or Novell's IPX protocols).

An example of these techniques is the E-mail accessible FTP servers. For users that don't have direct Internet access (a connectivity problem), but do have E-mail access (i.e., most non-Internet users), the user sends a short E-mail message to the FTP server describing the file to send. The FTP server sends an E-mail message back that contains (encapsulation) the file desired. If the transferred file is a binary file (E-mail only transfers text messages), the FTP server might have sent it as a UUENCODE file that changes a binary file into a text file (conversion utility). Additionally, that file might be in TAR format — the file is actually a "container" of other files (encapsulation).

Performance And Responsiveness

Each protocol has different minimum requirements. Using round numbers, E-mail requires 1Kbps, FTP requires 10Kbps, and an X server requires 100Kbps. Throughput performance is not the only requirement. Sending a DAT cartridge via Federal Express and connecting to an X client for 24 hours both have the same throughtput (1Gb/day is approximately 100Kbps), yet the responsiveness is different (waiting a day for a mouse click to take effect would be unacceptable) and the cost is different (compare $9/day for Federal Express to $100/day for a leased line).

As a real life example, in the early days of USENET NetNews (an organization of volunteers transferring E-mail and forums), the throughtput requirements easily required a leased line between the US and Australia. The cost of that connection would have been tens of thousands of dollars per month, i.e., prohibitive. The solution was to batch all the messages every day or two and drop the magnetic tape in a pouch on a plane. The US and Australian sites that served as the gateways were able to function with only modest costs. This solution worked well because although the throughput requirements were high (about 100Mb/day), the responsiveness requirements were low (1-3 day response on a NetNews article is acceptable).

2.3 Electronic Documents

2.3.1 Edit Format

There are many file formats for saving an editable document. The following are recommended formats:

1. Text. Always popular. Works on any system. Unfortunately, graphics cannot be embedded.
2. Standard Generalized Markup Language (SGML). This ISO standard has been available since 1986. The format features an abstraction and feature superset of

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other well-known formatting systems: GML, Bookmaster, TEX, NROFF/TROFF, MM, RUNOFF. The main drawback is that the format can be terse, especially for people accustomed to WYSIWYG (What You See Is What You Get) word processors. Most word processing vendors have announced they will support SGML (read: WYSIWYG, user friendly front-end with SGML file format). X3J11 is using SGML as a basis for its Model Electronic Document Project.

3. HyperText Markup Language (HTML). This is an extension to SGML for embedding HyperText features within an SGML document. The work on HTML is in progress. X3J11 is investigating HTML.

The following formats were rejected for use as the file format.

1. Wordperfect, Microsoft Word. These formats a controlled by a single vendor. Also, there have been compatibility problems when importing older documents into newer versions of the word processor (read: poor upward migration). Members may use these formats as long as they convert to/from SGML without loss of information.
2. TEX, NROFF/TROFF, MM, RUNOFF. These formats are widely available and all are very similar. These formats have remained stable for 10-20 years and there is public domain source code for tools. Most of this work has been incorporated into the SGML standard.
3. Postscript. This format is great for printing, but poor for editing. The reason is that most of the document information is lost. There are some tools that convert Postscript to a text format (which could be edited), but much work would be required convert that back to the original Postscript again (!).
4. Adobe Acrobat. The same problems as Postscript, except that this format and its tools are not widely available.

2.3.2 Display Format

There are several formats for printing or displaying documents.

1. Postscript. This format is widely available on printers. Also, there are many public domain tools (e.g., Ghostscript) and commercial tools (e.g., Adobe Acrobat) for displaying documents on the screen.
2. ASCII flat text file. This format may be desirable for documents with simple formats and/or publicly available data files.

The following formats were rejected for use as the printing format.

1. HP PCL. This is not necessary anymore since Postscript is widely available.
2. Adobe Acrobat. This features interactive capabilities, but it is a new product under development. Basically, it is an extension to the functionality of Postscript with a completely incompatible syntax. Currently, ACM is distributing a CD-ROM that requires an Acrobat reader (as one display format). The commercial product (Acrobat) is only available on a limited number of

platforms.

3. ANSI X3.64 format file using format effectors. There isn't much hardware support (printers) or software support (full X3.64, not just VT100 compatible) for this protocol. It is marginally better than an ASCII plain text file. It cannot embed graphics.

2.3.3 Paper Documents

There will still be some paper documents. Text documents can be converted with OCR. Other documents can be scanned as graphics.

Faxes can be converted to/from paper. Faxes can be sent, received, and retransmitted electronically. In the future, the CCITT T.131 protocol may be used to transfer electronic documents to fax machines.

The use of paper and/or faxes for document distribution should be minimized.

2.3.4 Summary

CBEMA should promote SGML has the file format for its documents. For users that don't have SGML tools, a limited set of alternate file formats can be used for exchanging files (e.g., Microsoft RTF format, Ventura Publisher, NROFF/TROFF, TEX). However, the documents should be converted to SGML format for storage on the CBEMA server. X3J11 is willing to share its publicly available tools with CBEMA.

Postscript should be the display format for documents. Given its widespread availability and display tools, this is an easy choice.

Paper and fax documents should be handled on an individual basis. If the committee desires conversion from paper to text (OCR), then either the committee should perform the task itself or pay CBEMA to do it (similar to the way photocopying works now).

2.4 Change Control System

2.4.1 Version Control

The version control system (SCCS, RCS, CVS) maintains successive versions of a file. Each person that intends to edit the file first checks out the file for edit (assuring that the latest version is retrieved), makes the changes, then checks the changes into the version control system. During check-out, no other user can check-out the file for editing (prevents more than one person from editing the file at the same time). The version control system, its features, and its administration have been discussed in detail above.

2.4.2 Release Control

The release control system manages major releases of file (e.g., current draft, draft standard, standard). The release control system can manage a bundle of files the comprise the major release. The release control system has been discussed above.

2.4.3 Administration

Only authorized people will have access to the files. Some people make have read/write access to the editable (SGML) file (e.g., editors). Others will have read-only access to the editable file (e.g., the committee). Finally, some will have read-only access to the display (Postscript) file (e.g., reviewers and purchasers). The file administration has been discussion above in the details of the version control system.

2.5 Public Review and Defect Reports

The public may provide feedback as comments or defect reports. Most problem tracking systems for software can be used to log and track feedback on standards documents. The use of problem tracking software to manage the comments is advantageous to committees because it provides a higher quality of review (public comments aren't lost; the dispostion of all comments is quickly available). There are many systems available to support this process.

A problem tracking system should handle the following ("comment" means public comment, request for interpretation, or defect report):

1. Who can submit a comment? Only members? Only national bodies? The general public?
2. Comments need to have a "comment ID" assigned automatically. This helps tracking comments.
3. Who can examine existing comments and their progress log? Only members? The general public?
4. What is the "state" of the comment? The following states are required:
   - Entered. The submitor has filled out the form.
   - Accepted. The comment was accepted as a valid comment.
   - Rejected. The comment was rejected for the stated reason (e.g., lack of information, wrong format, no issue specified).
   - Assigned. The comment was assigned to an individual or a group for processing.
   - Responded. The comment produced a response (e.g., Record of Response).
   - Duplicate. The comment duplicates the previous comment. The comment ID of the related comment is attached to the progress log.
   - Change request accepted, but not yet incorporated. The comment requires a change to the document (e.g., Technical Corrigendum). The change to the document has been authorized, but the revised document has not yet been published.
   - Change request accepted and verified. The authorized change has been made and verified (tested) in the newly published document.

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- Change request resubmitted — unable to verify. The authorized change was intend to be made, but was no in the newly published document ("You said you fixed the bug, but the problem still happens in the new release."). The comment is automatically resubmitted as a new comment.
- Change request postponed. The change has been authorized, but it a future release of the document.
- Change request accepted, verified, and approved. The authorized change has been made, verified (tested) in the newly published document, and approved by the parent body.

Each committee may want to include additional states that are suitable to their work process. Along with the states, there are transactions that change the state:

- Create a new comment. Done be the submitor.
- Accept/reject a comment. Done a a review committee that makes a first pass over new comments.
- Resubmit comment. The submitor supplies additional information.
- Escalate comment. The submitor is unhappy with the response. Each committee must agree on escalation procedures, if any.
- Assignment. The review committee assigns the task to an individual or group (the implementor).
- Supply additional comments. The submitor or any authorized member may supply notes, comments, and other information to be attached to the progress log.
- Disposition. The implementor decides to: accept as a comment (thank you for sharing), accept as a change, accept as change for a future release (e.g., a future revision of the standard), or reject the change request.

Management reports must be available to quickly determine the state of the comments:

- List of comments outstanding. This is the list of work to do.
- List of comments with no assignment. This is a list of the work where the "ball has been dropped" — not assigned to anyone.
- List of comments with state X, e.g., rejected, postponed, accepted but not verified, closed, and so on.
- Automatic E-mail (fax or postal letter) generation when a comment is changed, added to, reassigned, applied, or closed.
- List of progress log for individual comment ID's.

Again, most committees may need to tailor the process to their own needs.

X3J11 has been using a semi-automated process over the past three years. X3J11 makes recommends that a problem tracking system with these capabilities, but X3J11 makes no recommendation for specific problem tracking software. Over the next six months, X3J11 will be increasing the automation involved in this process (automated comment submission).

2.6 Distribution

During the transition to electronic media, CBEMA will still need to maintain other forms of distribution media. CBEMA should prepare for the following methods of distribution:

1. Paper. This medium will still be required for many years.
2. Fax. This medium is useful for short messages, e.g., notices, small documents, ballots.
3. E-mail. This medium is useful for discussions and for sending documents to members not directly connected to the Internet.
4. FTP access. Useful for unattended downloading of documents.
5. Floppy distribution. Depending upon cost and connectivity, some members may desire this media.
6. CD-ROM. Useful for distribution large volumes of documents.

Each member should decide the appropriate media for themselves. CBEMA make introduce incentives (e.g., reduced membership fees) for members that use more convenient media.

2.7 Scheduling

There are three choices for mechanizing scheduling: provide a solution to all members, provide an solution only for CBEMA staff, provide no solution. For most scheduling software, the training issues and accessibility issues (e.g., remote X sessions) outweigh the usefulness of the tool. X3J11 recommends a low-tech solution for members (E-mail) while allowing CBEMA to choose low-tech (pencil and paper calendar) or high-tech (network scheduler) for internal use.

For non-CBEMA staff (e.g., committees), CBEMA should supply an E-mail address for a meeting secretary. The requestor should use a template for making the request (the template is available via FTP or E-mail autoresponder). Requests via fax and telephone (voice mail) are possible, too.

Internally within CBEMA, a paper calendar (for low volume) or network scheduling tool (for high volume) should be used. Members may access a copy of the schedule, updated daily, on the CBEMA server (text and/or Postscript file).

2.8 Performance

This section covers the performance analysis and requirements of the system.

2.8.1 Wide Area Network Performance

The RFI suggests use of a 56Kbps leased line for access to the CBEMA server. This estimate is off by a factor of 17. Based upon the RFI requirements:

— 300 users simultaneously.

— Within a 2 hour period.

— Each transferring approximately 2MB.

This results in the necessary Session layer (FTP) performance of 667Kbps.

K = 1000
M = 1,000,000
B = byte
b = bit
ps = per second

300 users * 2MB * (8 bits / byte) / 7200 seconds
= 667Kbps

Typically, 30% of the Physical layer bandwidth is lost to protocol overhead.

667Kbps / .70 = 935Kbps

Most likely, a T1 connection (1.544Mbps) will be the minimum acceptable performance for the wide area connection to the server.

2.8.2 Local Area Network Performance

For broadcast-based non-deterministic local area networks (e.g., Ethernet), 30% of the Link layer performance should be considered the maximum limit for planning purposes. A typical Ethernet (thick, thin, or twisted pair) that operates at 10Mbps would provide approximately 3Mbps of usable bandwidth. Thus, Ethernet performance would be acceptable (3Mbps > 935Kbps) for this RFI. The choice of thick, thin, or twisted pair media is based on the physical qualities of the site, which were not specified in the RFI.

2.8.3 Filesystem Performance

Based upon actual measurement, most filesystems of high-end PC's and workstations have a maximum steady state performance of 100KBps (800Kbps). This performance is independent of processor speed, memory (RAM) availability, and controller speed, i.e., buying a faster processor, more memory, of faster controllers has little effect. The limiting features of filesystem performance for these systems are:

— Seek time. Regardless of how big the disk is, it still takes about 9ms to 13ms to position the heads.

— Latency. Most drives operate at 3600RPM. This means about 17ms per revolution, or about 8ms average latency (getting to the right sector).

— Non-striping. Most drives will only transfer data from one head at a time. More heads only increases storage capacity, not performance.

— Fragmentation. Most operating systems allocate blocks discontiguously. This improves allocation performance (database inserts and deletes) but reduces access performance (reads and writes). CD-ROM filesystems eliminate this problem (insert once, no deletes), but have much lower multi-user throughput due to poor seeking performance.

Many of these problems can be fixed, but at a much much higher system cost (e.g., a supercomputer). Spreading the workload over two or more lower cost systems is a simpler (and cheaper) solution.

Internet Addressing for Multiple Systems

Since there would be several systems, the Internet (IP) address must be unique for each system. While a single IP address could be used, this machine would become the funnel (bottleneck) for all transactions. Thus, the performance objectives wouldn't be satisfied. Although users wouldn't necessarily refer to systems by IP address directly (e.g., 192.0.0.1), they would refer to them by host name (e.g., `cbema.org`). Of course, a single host name doesn't solve the problem either. The recommended solution is make multiple host names, based upon committee name. For example:

```
192.0.0.1       cbema.org
192.0.0.1       x3h1.cbema.org
192.0.0.1       x3h2.cbema.org
192.0.0.1       x3h3.cbema.org
192.0.0.1       x3j1.cbema.org
192.0.0.1       x3j2.cbema.org
192.0.0.1       x3j3.cbema.org
192.0.0.1       x3j4.cbema.org
192.0.0.1       x3j5.cbema.org
192.0.0.1       x3j6.cbema.org
192.0.0.2       x3j7.cbema.org
192.0.0.2       x3j8.cbema.org
192.0.0.2       x3j9.cbema.org
192.0.0.2       x3j10.cbema.org
192.0.0.2       x3j11.cbema.org
192.0.0.2       x3j12.cbema.org
192.0.0.2       x3j13.cbema.org
192.0.0.2       x3j14.cbema.org
192.0.0.2       x3j15.cbema.org
192.0.0.2       x3j16.cbema.org
```

This allows the system administrator to partition the systems, as performance dictates, and rearrange them for disasters, upgrades, and so on. The reconfiguration is transparent to users since they would always refer to the system by host name.

Separate Host Name For FTP Access

Each committee should have a separate host name (not necessarily separate IP address) for FTP access. This allows for two important features:

1. The files for FTP access can be on a much larger file server that is well-connected (e.g., UUNET), yet the E-mail, forums, etc., can be on a much smaller machine, i.e., the filesystem capacity and wide area network performance requirements could be greatly reduced. Each committee should have a separate host name for FTP access, e.g., ftp.x3j11.cbema.org.

2. **Individual committees could maintain their own FTP sites, yet the user sees one homogeneous set of CBEMA FTP servers. For example, X3J11 has its own FTP site (ftp.dmk.com)** that is maintained by one of its members (David Keaton). Additionally, the host name `ftp.x3j11.cbema.org`) could map into the same IP address as `ftp.dmk.com`.

The following would be selections from a hypothetical host table:

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```
192.0.0.1       cbema.org
132.0.0.1       ftp.cbema.org
192.0.0.2       x3j3.cbema.org
132.0.0.1       ftp.x3j3.cbema.org
192.0.0.2       x3j11.cbema.org
195.1.2.3       ftp.x3j11.cbema.org
195.1.2.3       ftp.dmk.com
192.0.0.2       x3j16.cbema.org
132.0.0.1       ftp.x3j16.cbema.org
```

In this example, the FTP site for CBEMA, X3J3, and X3J16 are on, say, UUNET, but the FTP site for X3J11 is still at David Keaton's site. Meanwhile, all the committees are on CBEMA's machines.

This type of configuration allows the system administrator flexibility in addressing three issues:

1. Performance. If most of the high-bandwidth activity is elsewhere (not at CBEMA), then CBEMA's wide area network connection doesn't have to have as high performance as required in the RFI.
2. Internal cost. Reduced communication costs and system costs would leave money for other efforts.
3. External cost. Some committees might balk at additional X3 fees for this service, especially, if the committee is already providing this service itself.

2.9 Reliability

Multiple systems should be used for the fileservers. If CBEMA were configured with three systems, if any one of them went down (scheduled or otherwise), the systems could be quickly configured with different host name mappings, e.g., `x3j16.cbema.org` which mapped into 192.0.0.2 can be changed to 192.0.0.3.

2.10 Support Staff

2.10.1 System Administration

The system administrator is responsible for making sure the systems are working properly.

A POSIX-compatible system is recommended for the fileservers since POSIX system administration has much commonality from the smallest of PC's to the biggest of supercomputers, regardless of vendor. Thus, choosing hardware, for now and expansion, is a matter of performance and cost, not retraining and different operations.

The system administration job will require a full time person. The system administrator will have the following responsibilities:

- Maintain mailing lists.
- Network monitoring and reconfiguration.
- Adding/changing/deleting users.
- Monitoring network and system performance.
- Monitoring network, system, and filesystem capacity.
- Monitoring dial-in lines (data and fax) and dial-out lines (fax).
- Backups and archives.
- Restoring lost and/or old files.
- Printing, batching, and mailing computer generated paper output.
- Supporting CBEMA staff.
- Scheduling preventive and corrective maintenance.
- A fallback in case the system librarian is out sick. The system administrator would only be required to have knowledge of emergency system librarian tasks, e.g., controlling access to documents.

2.10.2 Librarian

The system librarian is responsible for maintaining the files, databases, indexes, version control, and paperwork flow. While the system administrator is responsible for the equipment, the system librarian is responsible for its contents.

The system librarian will have the following responsibilities:

- Controlling access to documents for editors, officers, and other officials of the committees. Note: The editors, for example, may grant additional access to other users, but that is not the responsibility of the system librarian.
- Creating work areas for new committees.
- Deleting and/or renaming any files.
- Supervising the electronic balloting process.
- Administering any user or chargeback fees.
- Generating usage reports and their billing statements.
- A fallback in case the system administrator is out sick. The system librarian would only be required to have knowledge of emergency system administration tasks, e.g., monitoring (not reconfiguring) the network, system shutdown and startup, system backup (loading tapes), and changing user passwords.
- Supporting CBEMA staff and X3 committees.

3. IMPLEMENTATION

This section addresses implementation issues. The section is organized in layers from hardware and software up to support and training.

3.1 Hardware

Based upon the RFI, 2-3 workstations will be required to support the number of users, filesystem performance, and reliability requirements. The hardware should support enough local storage, CD-ROM drives, scanners, printers, network devices, and graphics displays. Possibly, a write-only CD-ROM drive and a floppy duplication machine may be useful. X3J11 makes no recommendations for the choice of hardware.

3.2 Software

The operating system should be POSIX-compliant, support TCP/IP, FTP, TELNET, SMTP, NFS, NetWare, X, UUCP, NEWS, support ISO/ANSI C compilation system. For smaller systems, several POSIX systems are available on 80386's (Novell, Sun, SCO, IBM, LINUX). There are many workstation vendors that support POSIX (e.g., Sun, HP, IBM, DEC, SGI, etc.). X3J11 recommends that CBEMA use the purchasing procedures of the US government for POSIX-compliant systems.

3.3 Communications

Wide area networking services that connect to the Internet are available from UUNET and PSI among others. Most vendors will supply the routers, local phone company leased lines, modems, configuration, and consultation.

3.4 Applications

The following application should be purchased:

1. SGML text processing system.
2. Fax modem software.
3. Optical character recognition (OCR) software.
4. DOS/Windows emulation software (e.g., SoftPC or DOS-Merge).

3.5 Installation

The system is not well-defined enough to make installation recommendations. Also, no information about the site was contained in the RFI.

3.6 Operations

The system is not well-defined enough to make recommendations about operations. It is expected that the CBEMA system will be operational 24 hours/day, but attended only during business hours.

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3.7 Support

CBEMA must arrange for support for the following:

1. Hardware support. A 5 days/week, 8 hours/day, 2-hour response maintenance contract is required.
2. Software support. A 5 days/week, 8 hours/day, immediate response maintenance contract is required.
3. Network support. Most service providers support the network 24 hours/day, 7 days/week.
4. Other support. Off-site backup and disaster recovery site should be arranged.

3.8 Services

CBEMA should prepare to provide floppy duplication and CD-ROM mastering services.

3.9 Staffing

Two full-time support staff are required: the system administrator and the system librarian.

3.10 Training

Assuming no prior knowledge, the system administrator may require up to two staff-months training over the first 6-12 months. This training requirement can be greatly reduced by finding capable people. The USENIX organization has access to many system administrators though its SAGE organization (UNIX system administrators). CBEMA should contact USENIX for recommendations of capable people.

The system librarian will require about one staff-month of training to learn how to use operating system (POSIX) commands and the version control system. Again, USENIX might be helpful in recommending qualified people.

3.11 Roll Out

The most important aspect of this RFI is **the development of procedures** for electronic media, not as much the newness of technology. The following are the rough dates of the significant milestones:

- 1994-10: A methodology is chosen. A paper is distributed to the X3 members that describe the methodology and the plan. CBEMA may ask X3 members to respond via E-mail to get some experience receiving public comments from a (hopefully) friendly audience.
- 1995-01: All comments received. CBEMA works on a revised plan.
- 1995-04: CBEMA issues the revised plan. A small number of committees are chosen as the first group to try these methods. The group chosen should be based upon their use of the system, i.e., choose a group that is actively working on documents and receiving public review.

- 1995-10: Trial period ends. CBEMA makes recommendations for new procedures for X3 committees to follow. CBEMA requests implementation plan for those committees willing to participate.
- 1996-04: Implementation plans are due.
- 1996-10: X3 committees have completed implementing the electronic media and distribution.

3.12 X3J11 Experience

X3J11 has been automating is procedures over the past five years. The following are highlights of the procedures.

3.12.1 Electronic Distribution

X3J11, X3J11.1, and SC22/WG14 each have their own E-mail reflectors. Since X3J11.1 was merged with X3J11, the E-mail reflectors have been merged. The reflector is used for:

1. Distribution of minutes (text and Postscript).
2. Distribution of documents (text and Postscript).
3. Discussion of defect reports.
4. Discussion of technical papers.
5. Freewheeling discussion of technical issues.
6. Meeting announcements.

Some X3J11 subcommittee (FPCE and DPCE) have established their own reflectors for selected discussion.

3.12.2 Electronic Documents

X3J11 is experimenting with electronic documents. X3J11 is implementing the methods described above. The Model Electronic Document Project (the only work authorized so far) completes in 1994-12 with the conversion of the existing C standard to SGML.

3.12.3 Balloting

At the 1994-07 SC22/WG14 (ISO C) meeting in Tokyo, the committee agreed to experiment with electronic straw poll balloting over the next 6-12 months to attempt to resolve issues sooner. Since straw polls aren't official, the issues of authenication aren't as important. The purpose of this experiment is to get experience with the ballot process using electronic means.

3.12.4 Public Review

Currently, X3J11 has two pending tasks with respect to public review: receiving defect reports and receiving comments on its soon to be published technical report. Some defect reports are received electronically on the WG14 E-mail reflector. WG14 procedures require a member nation to "sponsor" the defect report (i.e., accept as an official comment).

X3J11's technical report has been receiving comments for years on its E-mail reflectors. The discussion over the reflectors has helped reach consensus on technical issues.

3.13 Business Case

There are only two important issues to address: how much it costs, how will it be paid for.

3.13.1 Cost Estimate

Based upon similar systems, the following are "round" figures for estimating the cost of the system. The initial cost of the system will be:

$120,000 for three workstations
$8,000 for CD-ROM mastering unit
$5,000 (?) for floppy duplicating system
$5,000 for two high volume printers

$10,000 for C compilation system
$5,000 for SGML system
$10,000 for other miscellaneous software

$10,000 network router and modems

$20,000 (?) site preparation

$193,000 total initial cost

The ongoing operational cost per year will be:

$15,000 hardware maintenance
$5,000 software maintenance
$36,000 wide area network connection
$140,000 support staff

$196,000 total annual operating cost

If the systems were reduced to 80386 PC's running a POSIX-compliant system, the initial cost might reduced by $80,000 and the operating cost might be reduced by $5,000 per year.

3.13.2 Revenue Estimate

As mentioned above, there will be little possibility of diverting income from ANSI. If CBEMA, sells documents, it will generate little revenue (ANSI will want a large portion). CBEMA can raise the fees it charges its members, but members are leaving already due to the high X3 and International Program Fees (IPF). In fact, the expected operating cost of this system is about the same is the total IPF cost. In X3J11, the fees already provide much hardship for the smaller *and larger* companies. If the IPF were doubled, X3J11 would likely lose much of its membership (the members might find another forum for standardizing). X3J11 expects that many other X3 committees feel the same about the fees. Thus, CBEMA would need to: (1) fund this itself, OR (2) greatly reduce the scope, OR (3) get X3 members to volunteer to perform the service.

3.14 Alternatives

A possible alternative is for CBEMA to supervise other committees as they prototype this system. After sufficient experience, CBEMA should specify the system (a standard-like document) and sanction (certify) certain organizations to perform this service (e.g., volunteers within committees). This is similar to the way X3J11 is proceeding: its automation comes from member companies donating their time and services. This approach is not what it called for in the RFI, but it is worth mentioning.

3.15 Conclusions

X3J11 recommends that CBEMA establish procedures for automation and review them with the X3 members. Once the procedures have been established, then CBEMA should use the usual procurement procedures to purchase the necessary system. CBEMA should investigate sanctioning volunteer sites (committee members, UUNET, etc.) for providing the automated services.

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