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**Federal Energy Regulatory Commission
Electronic Filing Strategic Plan
and
Information Technology Architecture**

4 August, 2000



The Federal Energy Regulatory Commission



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and
Information Technology Architecture**

4 August, 2000

prepared for
The Federal Energy Regulatory Commission
by
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and
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Section 1 – Introduction

1.1 Purpose

The purpose of the Federal Energy Regulatory Commission (FERC) Electronic Filing (E-Filing) Strategic Plan is to provide guidance to the Commission as it moves forward with its E-filing initiative. The heart of the Strategic Plan is an E-filing Information Technology Architecture (ITA) that specifies a Technical Reference Model (TRM) and a Standards Profile to guide the initiative.

The Information Technology Management Reform Act (ITMRA), or “Clinger-Cohen” Act of 1996, requires Federal agencies to develop information technology (IT) architectures that provide guidance and direction to IT programs. The E-filing ITA TRM and Standards Profile provide E-filing project managers and system designers with the information they need to successfully build an E-filing system and architecture and evaluate the conformance of the architecture to E-filing-related standards.

1.2 Background

The Federal Energy Regulatory Commission is an independent regulatory agency that regulates essential aspects of the electric, natural gas and oil pipeline, and nonfederal hydropower industries. It ensures that the rates, terms and conditions of service for segments of the electric and natural gas and oil pipeline industries are just and reasonable. It authorizes the construction of natural gas pipeline facilities. It ensures that hydropower licensing, administration, and safety actions are consistent with the public interest. The Commission’s main areas of responsibility are:

Energy Markets:

- transmission and sales for resale of electric energy in interstate commerce;
- transportation of natural gas in interstate commerce;
- transportation of crude oil and petroleum products by pipeline in interstate commerce;
- corporate transactions, mergers, interlocking directorates, and security issues of electric public utilities; and

- certification of exempt wholesale generators and qualifying facilities.

Energy Projects:

- licensing and safety inspection of nonfederal hydropower projects;
- construction and operation of natural gas pipelines; and
- oversight of related environmental matters.

The industries that the FERC regulates are required to file numerous types of legal and regulatory documents with the Commission. Currently, virtually all of these filings are submitted, processed, and retained in their native paper format. The FERC has put into motion an Electronic Filing Initiative designed to provide an electronic submission option to traditional paper filings, in accordance with the requirements of the Government Paperwork Elimination Act of 1998. The initiative is also driven by the Commission's strategic objective of improving information availability and exchange by increasing reliance on electronic filing and data bases and by making greater use of appropriate information technology tools.

According to the Office of the CIO, the vision statement for FERC's E-filing Initiative reads:

"We will provide Commission staff and our customers (regulated entities and the general public) with efficient, cost-effective access to the information they need—when they need it—and in a format that is useful to them."

Similarly, FERC's E-filing Initiative goal statement is:

"To provide more information to Commission staff, regulated entities, and the public in a more flexible, practical, and efficient way and to improve our regulatory processes by reducing the cost and volume of paper filed by applicants and intervenors with FERC and each other."

E-filing presents many challenges to the FERC. The Commission must not only change the way it does business, it must change the way it interacts with the entities it regulates. The IT-based E-filing system must meet evolving federal requirements for new technology investments—including proper planning facilitated by an ITA, adherence to non-proprietary industry standards, and the use of Commercial-Off-The-Shelf (COTS) products—while keeping within budget constraints that are established to help maximize benefit to the American tax payer.

1.3 Document Organization

The FERC Electronic Filing Strategic Plan is organized into five sections.

- Section 1 – Introduction. This section provides the necessary background information.
- Section 2 – Core Filing Requirements. This section presents the functional, performance, and electronic document and records management requirements of E-filing.
- Section 3 – Information Technology Infrastructure. This section outlines the current IT environment and identifies relevant technologies.
- Section 4 – E-filing Information Technology Architecture. This section uses Sections 2 and 3 as a foundation to build the ITA—which defines the Technical Reference Model and the Standards Profile for the E-filing infrastructure. Also included are guidelines for managing the ITA.
- Section 5 – The Future of E-Filing at FERC. This section discusses the goals and benefits of E-filing. It also addresses the implementation considerations of transitioning to a totally paperless environment.
- Appendices – The Appendices include a Glossary and an overview of the FERC E-Filing Pilot Project.

1.4 References

The following were used in the preparation of this document:

- Federal Energy Regulatory Commission Strategic Plan FY1997–FY2002
- Electronic Filing: Major Issues Summary
- FERC Website: <http://www.ferc.fed.us>
- FERC Electronic Filing Initiative Website: <http://www.ferc.fed.us/efi/efi.htm>
- National Archives and Records Administration Information Server: <http://webgopher.nara.gov/>

- Federal Energy Regulatory Commission – FY2000
Congressional Budget Request
- Federal Energy Regulatory Commission – FY2001
Congressional Budget Request

Section 2 – Core Filing Requirements

2.1 Overview

As regulated industries become more competitive, FERC Strategic Plan FY1997 - FY 2002 Strategic Vision recognizes the importance of flexibility and innovation in meeting the FERC's business needs. The FERC is committed to making changes that will allow it to "...respond in real time to industries and intervenors..." and will "...include better use of electronic technology to facilitate the regulatory process." The E-filing initiative is a direct response to the FERC's strategic vision. The FERC's long-term goal is a primarily "paperless" filing environment with a specific target of reducing paper filings by 90% by 2002.

This section addresses the business functions that E-filing supports, the goals and requirements of the initiative, information flows, data entities and their relationships, and document and records management requirements.

2.2 Supported Business Functions

As mentioned, the FERC's long-term goal is a primarily "paperless" filing environment. To that end, E-filing must support all business functions currently related to filing activities. At the highest level, this includes receiving, processing, storing, and retrieving all documents filed with the FERC.

In the Commission's four program areas (gas, oil, electric, and hydropower), regulated entities collectively file more than 400 different types of pleadings, comments on rulemakings and offers of settlement, forms, and reports. The major filings include:

- Motion/Notice of Intervention
- Comments on a filing, rulemaking, or offer of settlement
- Electric, gas, and oil rate applications
- Gas pipeline certificate (construction) applications
- Hydropower Licensing/Relicensing Applications
- Annual and periodic reports and forms filed by regulated entities
- Briefs and Testimony

- Complaints, petitions, protests, other motions, and answers to such pleadings

While many documents are text-only, others may contain maps of various sizes, CAD drawings, photographs, spreadsheets, or other structured data or text formats.

2.3 Primary Information Flows

In an effort to support the Strategic Plan and Information Technology Architecture for the FERC Electronic Filing Initiative, two process flows are defined in this section. Currently FERC documentation is received in two ways, via the Electronic Filing Pilot Program (Internet), and manually. Although manual entry of documentation information is not the preferred method, to define this process further supports the requirement of the Electronic Filing Initiative for this project. See Exhibit 2-1.

2.3.1 Process 1 – Electronic Filing Pilot Program (Internet)

1. Filings (Forms, Comments, Protests, and Interventions) are processed through FERC via Internet (web browser, client/server applications, distributed executables or e-mail). Once FERC receives the document, the sender receives an HTML acknowledgement of receipt, followed by an e-mail confirmation with a page link to the document in the FAMIS database.
2. The electronic submission goes through OSEC for quality control, including verification that the docket and sub-docket numbers are correct.
3. If the document is approved, OSEC forwards electronic submission to the RIMS database for customer retrieval and viewing.
4. If the document is not approved, OSEC sends a notification to the filer with an explanation as to why the document was not accepted.
5. After docket or sub-docket number is verified, OSEC sends the the paper copy of the filing (required only during the Pilot) to the RIMS database to create TIFF images, indexed, and stored.
6. Through FAMIS a workflow is initiated.

2.3.2 Process 2 – Manually Received Documentation

1. Customer submits filings to the FERC (e.g., via courier, express mail and regular mail.)
2. The document is sent to OSEC and quality controlled using paper acceptance criteria, if approved, depending on the type of submittal (new or existing), OSEC assigns a docket or sub-docket number.
3. If rejected, OSEC notifies the customer with the rejection reason.
4. The filer is required to submit an original and the required number of copies. For comments, interventions, and protests, the required number of copies is 14. For other submissions, the number of copies may be less, depending on the requirement in the regulations. In a few cases, OSEC will make copies, but they do not normally have to do this. They distribute the copies that are filed with the original.
5. The document is quality controlled again at the same time it is sent to RIMS to create TIFF images, indexed, and stored.

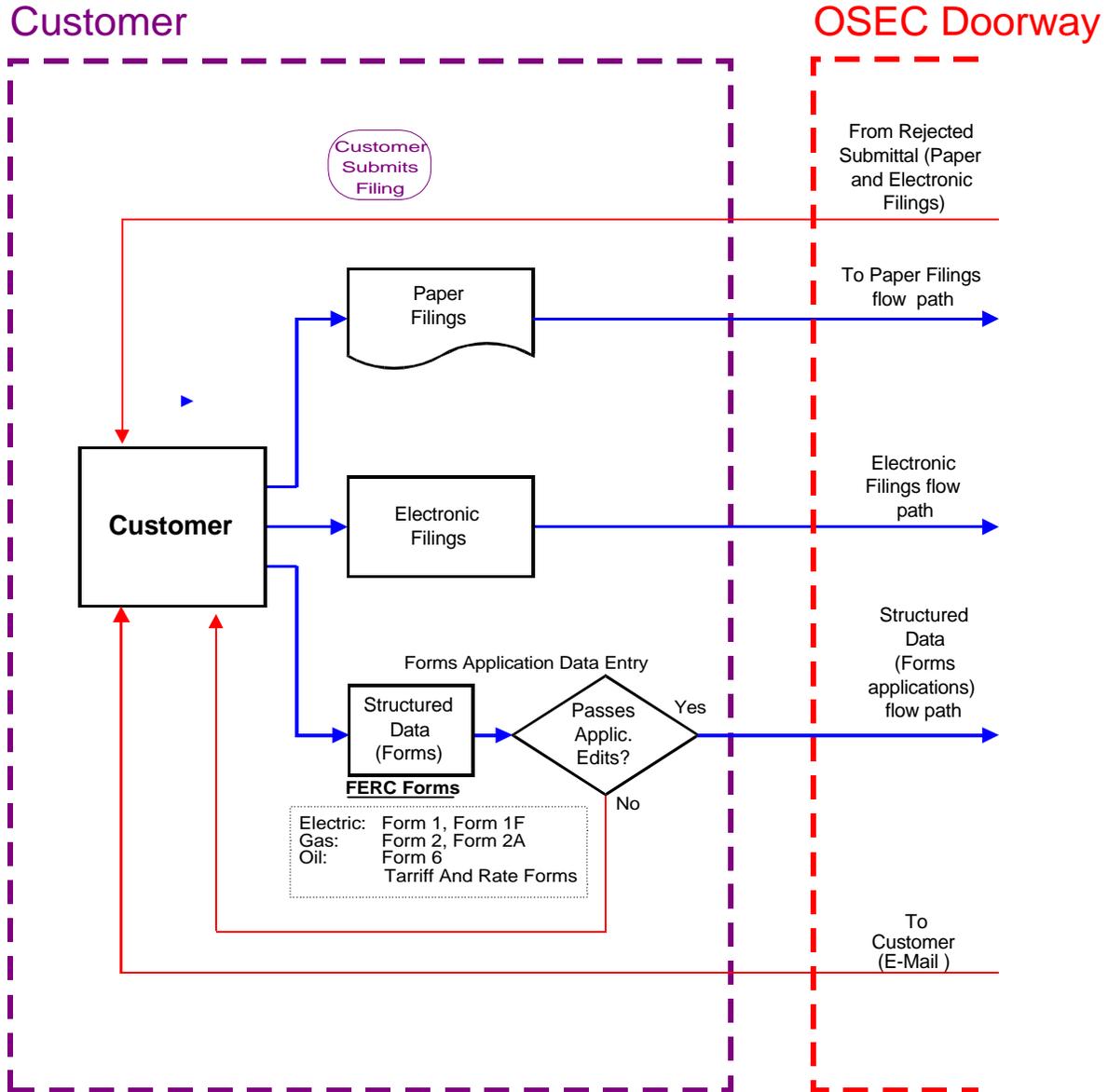


Exhibit 2-1. Present E-Filing Process

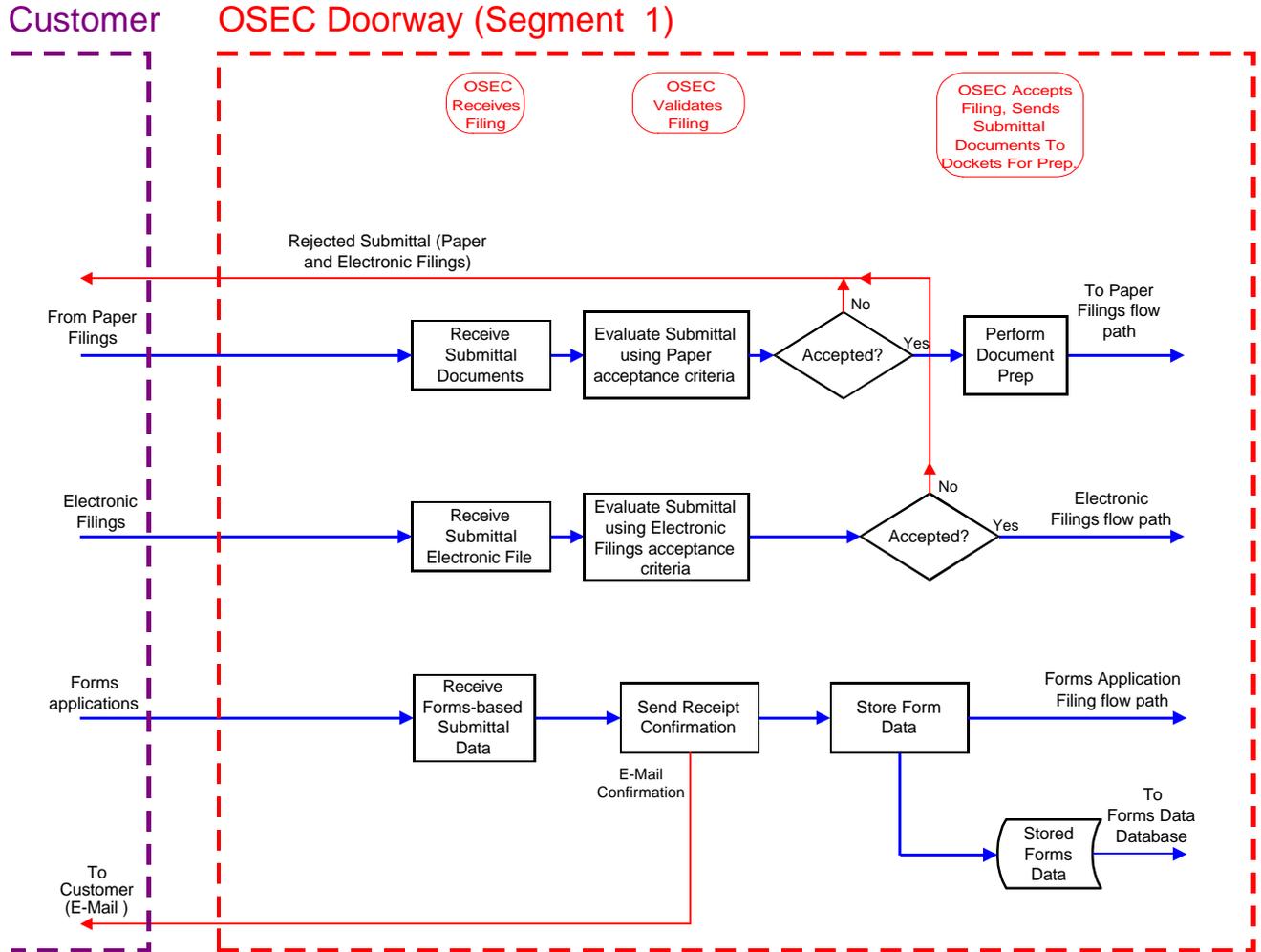


Exhibit 2-2. OSEC Doorway (Segment 1)

OSEC Doorway (Segment 2)

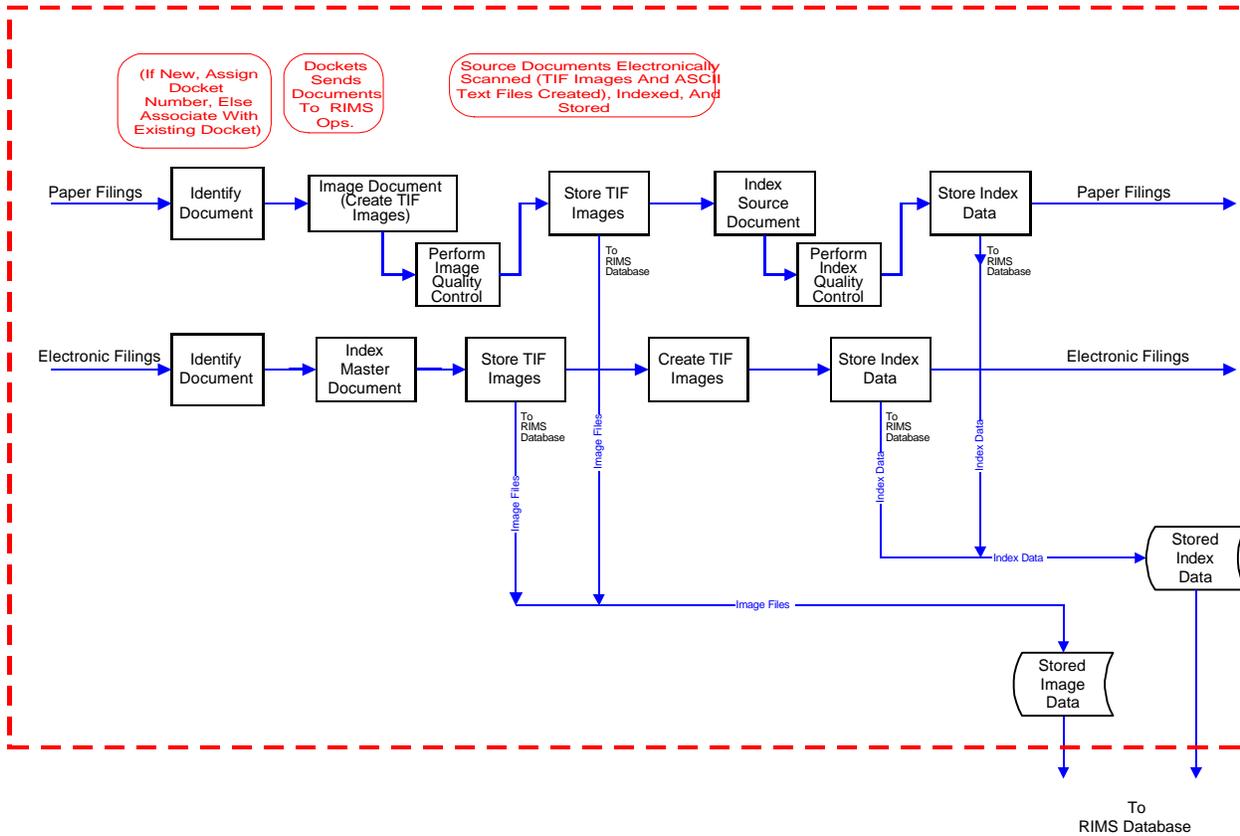


Exhibit 2-3. OSEC Doorway (Segment 2)

2.4 E-filing Requirements

E-filing goals and requirements are shaped by the business functions that E-filing supports. E-filing requirements are broken into two types—functional requirements and performance requirements.

The functional and performance requirements for E-filing are driven by strategic goals that will be attained by moving to a paperless environment. As stated in the FERC Strategic Plan, these strategic goals are:

- To provide stable and timely regulatory treatment to regulated companies and their customers. Expedite decisions where practical, while considering the due process rights of others
- To provide both staff and the public with information in a timely manner and in formats with more utility than native paper or electronically scanned documents

- To reduce the Commission’s overhead costs for administration and the costs of treating similar issues in similar cases.

2.4.1 Functional Requirements

2.4.1.1 Paperless Filing Environment

The core functional requirement of E-filing is that it must provide a paperless environment for “all” filings made with the Commission. A key success factor of this requirement is a well-planned, phased implementation. The FERC must be able to concurrently support paper filing until the transition is complete. Filing components such as maps and sensitive information are candidates for later phases—as technologies emerge and standards are established.

It is likely that paper will always be involved in some part of the filing process. For example, some information might be considered too sensitive to transmit over public communications media. Continued advances and wide-spread acceptance of technologies like Public Key Infrastructure (PKI) and Virtual Private Networks (VPN) could eventually obviate concerns in this area.

2.4.1.2 Workflow

Stable and timely regulatory treatment of regulated companies and their customers is a strategic goal of the FERC’s E-filing initiative. Automating the workflow of the filing process to provide an E-filing infrastructure is an important factor in achieving this goal. Workflow-related functional requirements for E-filing include both current, manual procedures (e.g., docketing of filings) and procedures that are new to the process (e.g., virus checking). E-filing automated workflow requirements include the following procedures:

- a) Receive Electronic Document – The FERC must be able to receive, view, and process all electronic document formats used.
- b) Validation – The FERC must be able to validate documents and authenticate their origin. They must also be able to automatically inspect submitted documents for adherence to business rules, proper numbering schemes, completeness, and accuracy.
- c) Virus Checking – The FERC must be able to automatically scan for and clean infected submissions. Also included in this process are automatic updates of virus patterns for detection of new viruses and automatic notice to the submitter that an electronic document was infected.
- d) Acknowledgement of Receipt – The FERC must be able to electronically acknowledge receipt of documents and either

confirm validation of filing or reject submittal with adequate explanation for rejection.

- e) Docketing of Electronic Filings – The FERC must be able to automatically docket electronic filings based on meta-data included with each filing.
- f) Notify Staff – The FERC must be able automatically notify the staff assigned to a specific case that related filings have been received.
- g) Access for Staff and Public – The FERC must provide access to filed materials for the Staff and Public in a timely and reliable manner.
- h) Perform Quality Assurance (QA) on E-filing – The FERC must be able to automatically check filings against business rules, E-filing standards, and accepted formats. Filers shall be notified if E-files do not meet QA standards.
- i) Accept waivers – The FERC must have an evaluation process for reviewing and accepting or denying waivers for late filings due to IT technology issues and non-standard submissions.

The functional requirements listed above outline the process for accepting electronic submissions at the Commission. The timeframe for this process is discussed in Section 2.3.2, Performance Requirements.

2.4.1.3 Digital Signatures

In May of 1998, the Commission solicited comments from industry on the E-filing initiative. One of the questions dealt with the authentication of submissions by physical signature. The FERC not only solicited suggestions for the method used for electronic authentication but also asked if signatures should still be considered as a requirement. Industry replies were mixed—some felt that a “signature” in some form should be required, others did not. Digital signatures will be required for some, but not all, filings. A risk assessment for each type of submission will be required to determine the method of authentication/validation/signature (if any) used for that type of submission.

FERC shall follow the procedure and guidance for implementing the Government Paperwork Elimination Act issued by the Office of Management and the Budget and published in the Federal Register (65 FR 25508 (May 2, 2000)).

2.4.1.4 Digital Maps and Large-format Graphics

Maps and photo-alignment sheets (normally included with natural gas pipeline certificate applications, hydropower licensing/relicensing

applications, and reports submitted to the Commission) are currently submitted on paper. Applicants do not normally serve this information to all parties. Currently, the FERC digitizes large-format graphics by scanning paper source maps into electronic format. The large file sizes of the resulting digital maps make it difficult to disseminate this information to the public. Eventually, the FERC should be able to receive, process, store, and disseminate maps that are produced in digital form. Digital maps will be part of a practical solution that allows interested parties to easily and quickly access required portions or areas of maps.

2.4.1.5 Secure Transmission and Storage of Proprietary Data

Some filings, such as annual reports, contain proprietary information that regulated companies need to protect—especially as industries move towards an unregulated, competition-based environment. The FERC must ensure that all electronic submissions containing sensitive information are transmitted and stored in a secure manner. Furthermore, the FERC must provide defined procedures for filing, receiving, and posting documents of mixed proprietary and non-proprietary content.

2.4.1.6 Web-enabled

The FERC understands that the Internet is a valuable tool in meeting its strategic goal of providing both staff and the public with information in a timely manner. The E-filing solution must be capable of interfacing with the current Internet, Intranet, and other web-enabled systems at FERC (i.e., CIPS, RIMS, and FAMIS).

2.4.1.7 Administration of E-Filing Process

The administration of the E-filing process shall be controlled by FERC. Specific requirements concerning the E-filing process shall not inhibit the ability of a system administrator to over-ride any specific business process. As an example, the administrator will need the ability to over-ride filing dates that are generated automatically in order to deal with exceptions to business rules.

2.4.2 Performance Requirements

2.4.2.1 Timely and Accurate Information

The E-filing system must provide timely and accurate information to the FERC staff and the Public.

At a deeper level, this requirement establishes performance metrics for the workflow defined in Section 2.1.3.2. The FERC must establish acceptable process duration times for receiving, processing, and posting electronically filed documents. These metrics should complement FERC

business rules for meeting filing deadlines and should align with Industry expectations.

For the FERC to ensure that information is accurate, the E-filing process must also include error checking and correction procedures. Just as in the current paper environment, the FERC must ensure that electronic filings are available As-Filed and adhere to established filing conventions.

2.4.2.2 System Availability

The E-filing system must always be available to the FERC staff and the Public during prime filing periods to accept time-sensitive filings. The system will be subject to peak filing periods driven by the deadlines for making certain filings. System availability shall consider these "busy hours" as a critical time period.¹

This requirement establishes performance metrics for availability. These metrics will define acceptable parameters for system uptime, periods of availability, and the overall level of service the FERC will provide. System availability also establishes requirements for infrastructure issues like bandwidth and connection speeds.

2.4.3 Electronic Document and Record Management Requirements

This section outlines the electronic document and records management requirements for E-filing at the FERC. The National Archives and Records Administration (NARA) requires that the Commission establish record retention schedules for all agency business records. This record retention requirement applies to records in any format. Records fall into two general categories: permanent and temporary. Permanent records include those appraised as having sufficient historical or other value to warrant continued preservation beyond the time they are needed for an agency's administrative, legal, or fiscal purposes. NARA becomes the legal owner of any permanent records transferred to NARA.

Temporary records have defined retention schedules. Most filings with the Commission are classified as temporary records, even though the retention period may be 50 years or more. The agency has greater discretion over temporary records because it retains legal custody.

The Commission must retain official records in a format that accurately renders a document for the duration of the retention period. For paper records, scanned image formats always reproduce the document As-filed.

¹ The telecommunications industry traditionally designs for the "busy hour" for the phone system. A comparative approach should be pursued for system availability by utilizing historical reports showing system utilization.

For electronic submissions, the ability to render a document As-filed may be hindered by the proprietary software application used to create the electronic submission. At present, only paper documents are considered official.

The Electronic Document and Records Management requirements are discussed below.

2.4.3.1 Ensure compliance with NARA

Electronic filing shall ensure compliance with NARA and other Federal Regulations for Records Management.

2.4.3.2 Public Access to Electronic Documents

Documents submitted in electronic format must be available to the public in electronic format. Additionally, it is required that document retrieval, via the Internet, not require a proprietary for-purchase software solution to enable viewing by the public. All documents filed electronically must be capable of being printed as paper documents without loss of content or appearance.

The Commission's Records Management System will retain the original submission "as-filed". The original document cannot be altered and will be retained in its original format. Processing of the document for web viewing will render the document in a new format but no additional alteration of the document will occur.

2.4.3.3 Document Retention

Document retention requires that the electronic document be viewable for the duration of its legal retention schedule. As a consequence of this, and other issues, a Pilot Project was initiated which has adopted a multi-phased or evolutionary approach to the Electronic Filing Initiative. This will require that document content standards be defined to ensure that the electronic documents can be accepted, disseminated and distributed in a timely manner. Presently, the most popular format used for document viewing is Adobe's Portable Document Format (PDF). PDF files typically require a proprietary document viewer; however, this is distributed free of charge from Adobe. Document creation, in a PDF format, requires either the proprietary Adobe Acrobat® application or a separate application that has implemented the PDF standard.²

² Adobe has released the PDF specification that provides other vendors the opportunity to create their own PDF writer. For example, Corel's WordPerfect (V 9.0) can generate a PDF output.

In addition to PDF, there are other non-proprietary solutions could be implemented. Other phases of the E-filing initiative will require investigating XML (Extensible Markup Language), SGML (Standard Generalized Markup Language), as well as other emerging non-proprietary technologies.

2.4.3.4 File Format and Retention

The FERC receives documents that can be classified into two categories:

1. Structured Data, typically contained in forms, and
2. Unstructured Data, from Comments, Protests, and Interventions.

For accountability purposes, the Commission shall retain submitted unstructured data (i.e. documents) in both the original file format as well as the converted non-proprietary file format.

2.4.3.5 File Format Standards

The Commission shall endeavor to support standard file formats that obviate single vendor software applications. Standard file formats are developed and ratified by nationally or internationally recognized standards bodies. (See File Format Retention.) There are certain situations, however, where the Commission will have to accept proprietary formats. In natural gas pipeline and electric transmission rate cases, the formulas underlying the spreadsheet entries for certain schedules are of interest to staff. So rate case filers may be required to submit that information in one of several proprietary spreadsheet formats. It will also be necessary to accept certain filings in proprietary formats from people who are not able to create a filing in a non-proprietary format without incurring additional expense.

The Electronic Filing Pilot project is presently accepting the following file formats:

EXTENSION	APPLICATION
wpd	Corel WordPerfect
doc	Microsoft Word
pdf	Adobe Acrobat
txt	ASCII ³

Particular emphasis should be placed on the Portable Document File format as it provides a platform and vendor independent solution.⁴ An inter-agency group within the federal government has recommended that the National Institute of Standards and Technology (NIST) develop a Federal Information Processing Standard (FIPS) for PDF; efforts are also under way to develop national (American National Standards Institute, ANSI) and international (International Standards Organization, ISO) standards for PDF based on this published specification. ANSI approved a PDF standard in October of 1999. This specific standard, CGATS.12/1, relates to digital pre-press. Digital pre-press and publishing is defined as "the process of preparing images for reproduction and/or dissemination by print or alternative media, including such options as multimedia, CD-ROM, on-demand printing and digital databases." The Committee for Graphic Arts Technologies Standards (CGATS) is continuing to study additional PDF standards. The ISO has assigned number 15930 to the PDF proposed standard. It is presently in review and comment phase and is expected to be classified as an official ISO standard in the year 2000.

2.4.3.6 File Format Virus Scanning

All documents submitted electronically must be in an approved file format so as to enable virus scanning by the FERC IT architecture. At present, no files can be submitted in a compressed or zipped format. It is

³ ASCII provides the least usability for electronic processing applications. It should be anticipated that ASCII will eventually be removed from the accepted formats list.

⁴ PDF, although created by Adobe, has been released into the public domain. Adobe's reader is freely downloadable. It is possible to generate PDF files without purchasing an Adobe product; e.g. WordPerfect Version 9.0 can generate PDF. Previous versions must install new print drivers.

anticipated that future phases of electronic filing, that include larger filing of multiple files, will have to accommodate compressed files.

2.4.3.7 File Format Paragraph and Page Numbering

Paragraph numbers are not required for files submitted in unalterable format i.e. PDF; paragraph numbers are recommended, but not required, for other file formats.

2.4.3.8 File Naming Conventions

Files name must be limited to a maximum of 25 characters, excluding the extension.

File extensions must follow an approved format. The following table defines the approved extension names identified for the pilot:

EXTENSION	APPLICATION
wpd	Corel WordPerfect
doc	Microsoft Word
pdf	Adobe Acrobat
txt	ASCII

2.4.3.9 File Size

Submitted documents are presently limited to five megabytes. Any system upgrades should include proper sizing of the system to include anticipated storage of approved file formats; e.g., maps converted to standard GIS formats.

2.4.3.10 Hyperlinks and other Embedded Code

Hyperlinks embedded within an electronic filing should refer only to information within the same document. Hyperlinks should not be used to refer to external documents or information sources which are likely to change. (i.e. web sites).

Documents must not contain auto-text generating features. As an example, most word processors have the ability to insert "Today's Date"; this feature initiates a "Save" request whenever the document is reviewed at a later date. Setting the document's properties to "read-only" will inhibit the document being overwritten but can still confuse the reader. Not implementing auto-text generating features will obviate this confusion.

2.4.3.11 Adherence to Regulations

- **Government Paperwork Elimination Act**

The Government Paperwork Elimination Act (GPEA), which takes effect in FY 2004, provides a strong impetus for agencies to develop the capability of managing records electronically for their full legal retention period. Under the GPEA (Pub. L. 105-277), by October 2003, agencies must give persons and entities that are required to maintain, submit, or disclose information to the Federal Government the option of doing so electronically when practicable as a substitute for paper, and to use electronic authentication (electronic signature) methods to verify the identity of the sender and the integrity of electronic content.

As a consequence of this, the Commission shall review all document filing requirements and propose which documents meet the "practical" parameter as stated by GPEA. A phased implementation schedule shall be developed that reflects the milestone dates, as established by the GPEA, which can be implemented within the constraints of the supporting Information Technology Architecture. (ITA)

- **U.S. Code of Federal Regulations**

The regulations in 18 CFR 385 (U.S. Code of Federal Regulations, Title 18: Conservation of Power and Water Resources) that may need to be revised to accommodate electronic filing in general, and Phase 1 filings (Interventions, Comments, Protests, and Answers) in particular include:

- Rule 2001 (18 CFR 385.2001): Filings with the Commission. Expand to include method for electronic submission.
- Rule 2002: Caption of filings. Modify to include caption or description requirements for electronic filings.
- Rule 2003: Specifications. Modify to include any specifications that should apply to electronic filings, including those relating to citation.
- Rule 2004: Original and copies of filings. Modify to delete requirement to file paper copies with electronic submissions.
- Rule 2005: Subscription and verification. Expand to address signatures for electronic filings.
- Rule 2007: Time. Modify to include rules for establishing the filing date of an electronic submission.
- Rule 2010: Service. Clarify Certificate of Service procedure for electronic filings.

- Rule 2011: Procedures for filing on electronic media. Revise as additional filings are added to the filings that FERC can accept in electronic format.
- Rules specific to Motions, Protests, Answers, Interventions, Amendments and Withdrawal of Pleadings:
- Rule 203: Content of pleadings (and tariff or rate filings)
- Rule 208: Notice of protest to tentative oil pipeline valuations
- Rule 211: Protests other than under Rule 208
- Rule 212: Motions
- Rule 213: Answers
- Rule 214: Interventions
- Rule 215: Amendment of pleadings (and tariff or rate filings)
- Rule 216: Withdrawal of pleadings

2.4.3.12 Auditing Electronic Documents

FERC shall follow the legal guidelines for auditing electronic documents as defined by the OMB⁵ and the Justice Department.

By definition, a document management system (DMS) can track all data accesses and modifications. A DMS can keep prior versions of records and maintain an audit trail of the changes and who made them. FAMIS provides these capabilities for FERC.

2.4.3.13 E-Signature Standards

The Electronic Signature in Global and National Commerce Act (S.761) or E-Bill, recently signed by President Clinton, will establish a national standard for electronic signatures. This standard would allow businesses to replace paper records with electronic records regardless of the format the consumer used to authorize the transaction.

Digital signature standards based on public-private key encryption technology may be used both to authenticate filer identity and to ensure the integrity of a document's content. The Commission shall use different approaches for signature/authentication, based on the type of filing and the associated risks.

⁵ see OMB M-97-16.

2.4.3.14 Developing and Monitoring Recordkeeping Systems

The FERC shall verify that the Information Technology Architecture will ensure compliance with NARA regulations.

“Agency records officers should participate in the design and development of recordkeeping systems to ensure the proper disposition of recorded information. Such involvement is especially important in the design of electronic records systems. According to OMB Circular No. A130, agencies are to create or collect information 'only after planning for it's . . . use, storage, and disposition.'”

2.4.3.15 Electronic Document Designation

All electronic documents shall be classified as either Temporary or Permanent. The transition of Temporary electronic Document into Permanent electronic documents shall be properly defined with a clear delineation of responsibility (i.e. FERC versus NARA.)

2.4.3.16 Document Scanning

For paper records, all documents shall be converted (e.g., OCR/ICR) to a machine-readable format that always reproduces the document As-filed.

2.4.3.17 Information Capture and Duplication of Effort

Information should be captured and saved from e-files such that there is a minimized opportunity to require duplication of effort and potentially conflicting information.

2.4.3.18 Time & Date Stamping

All electronically filed documents will be stamped electronically with a data and time stamp.

2.4.3.19 Web Browser Capabilities and Impositions

Electronic Filing will require the end user to access the FERC systems via the Internet. As a consequence, a standard web browser will be required at the filer's facility. All FERC generated documents that detail the web-enabled systems should clarify that web access is not provided by FERC; i.e. the end user will require an Internet Service Provider.

2.4.3.20 Search Capabilities

Electronic filing shall conform to an industry standard so as to enable full text search and indexing as required.

2.4.3.21 Digital Pictures

Digital Pictures, such as those submitted for Dam Safety Inspection Reports, must conform to acceptable imaging standards.

Imaging Standards:

- Tagged Image File Format
- Joint Photographic Experts Group (JPEG)
- GIF (note: this is a proprietary CompuServe format; CompuServe has pursued licensing requirements for use of this format. An effort should be made to use an alternative non-proprietary format.)

2.4.3.22 Document Utility

Documents shall provide both staff and the public with information in formats with more utility than either paper or scanned images.

2.4.3.23 Accessibility

When developing, procuring, maintaining, or using electronic and information technology, the Commission shall ensure, unless an undue burden would be placed on the agency, that the electronic and information technology allows, regardless of the type of medium of the technology --

- (i) individuals with disabilities who are Federal employees to have access to and use of information and data that is comparable to the access to and use of the information and data by Federal employees who are not individuals with disabilities; and
- (ii) individuals who are members of the public seeking information or services from the Commission to have access to and use of information and data that is comparable to the access to and use of the information and data by such members of the public who are not individuals with disabilities .

When development, procurement, maintenance, or use of electronic and information technology that meets the published standards would impose an undue burden, the Commission shall provide individuals with disabilities with the information and data involved by an alternative means of access that allows the individual to use the information and data.⁶

⁶ Adapted from the “Workforce Investment Act of 1998”; Section 508: Electronic and Information Technology.

2.4.3.24 Privacy

The Commission will ensure that the Commission's use of information technology sustains, and does not erode, the statutory protections for personal information. Personal information contained in the Commission's systems of records will be handled in compliance with the Privacy Act of 1974.

Section 3 – Information Technology Infrastructure

3.1 Current Environment

The FERC Information Technology Infrastructure is a snapshot of the current IT environment at FERC. This section discusses FERC in terms of the current organizational structure, the functions within FERC, the applications used to support these functions, and the IT environment.

3.1.1 The FERC Organization

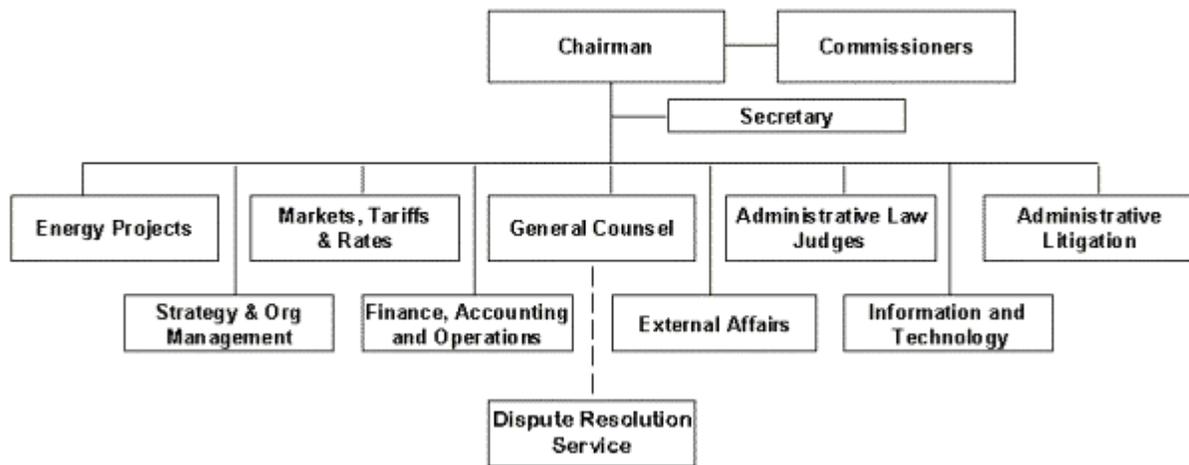


Exhibit 3-1. FERC Organization

The Commission was created by the [Department of Energy Organization Act](#) on October 1, 1977, to replace the Federal Power Commission. It is made up of five members who serve staggered five-year terms and are appointed by the President and confirmed by the Senate. No more than three commissioners may belong to the same political party. The Chairman, designated by the President, serves as the Commission's administrative head.

The Commission's legal authority comes from the [Federal Power Act of 1935](#), the [Natural Gas Act \(NGA\) of 1938](#), the [Natural Gas Policy Act \(NGPA\) of 1978](#), the Public Utility Regulatory Policies Act of 1978, and the Energy Policy Act of 1992. Read more [Enabling Legislation](#)

The Commission recovers all of its costs from regulated industries through fees and annual charges.

FERC comprises several divisions which work together to accomplish FERC's mission. See Exhibit 3-1. This document shall address the specific organizational structures, functions and applications that are specifically effected by the E-filing initiative.

The question “What is FERC?” is best answered by reading the Commission’s mission statement as stated in the FERC Strategic Plan FY 1997 – FY 2002. FERC’s mission reads:

“The Commission regulates, in the public interest, essential interstate aspects of four of the nation’s critical energy industries: electric power transmission and sales for resale, natural gas transportation and sales for resale, oil pipeline transportation, and nonfederal hydroelectric power. The Commission ensures that the rates, terms and conditions of service for the electric power, natural gas, and oil industries are just and reasonable and not unduly discriminatory or preferential, and that licensing, administration, and safety actions for the hydropower industry and other approvals for all four industries are consistent with the public interest. It administers numerous laws and regulations involving key issues...”

The major components of the FERC organization consist of twelve program offices. The program offices are:

- **The Office of the Chief Information Officer** – OCIO enables and supports the Commission's information technology (IT) needs and initiatives. The OCIO is responsible for meeting the requirements of internal and external customers, both to provide a stable reliable computing environment, and to provide access to information generated by and maintained by FERC, in a timely, user-friendly way.
- **The Office of the Secretary** –The Office of the Secretary (OSEC) plays a vital role in the FERC's document trail process. It is an office established by the Commission to serve as a focal point for filing proceedings before the Commission. In accordance to the Commission's Rules and Regulations, and as written in Chapter 18 of the Code of Federal Regulations, the Secretary issues notices of proceedings to the public in order to alert and invite them to participate in the proceedings. In addition, the Secretary is responsible for documenting and retaining the minutes that require actions taken during the proceedings. These minutes are taken by vote from the members of the Commission who are responsible for the issuance of official Commission rules and orders which includes service of documents on parties to the proceedings. The Office of the Secretary is also responsible to respond to inquiries from other

parties concerned with pending proceedings, requests for interpretations of Commission orders, rules, regulations, and decisions.

- **The Office of Energy Projects** – OEP has the engineering and environmental expertise to certificate new gas pipeline projects and to authorize and monitor hydroelectric projects. It focuses on project siting and development, balancing environmental and other concerns, ensuring compliance, and safeguarding the public. OEP combined the natural gas pipeline certificate staff from the Office of Pipeline Regulation with the Office of Hydropower Licensing. Both deal with environmental issues related to gas pipeline construction projects and licensing/relicensing of dams, respectively.
- **The Office of Markets, Tariffs, and Rates** – OMTR deals with matters involving markets, tariffs and rates relating to electric, natural gas, and oil pipeline facilities and services. It plays a lead role in monitoring, promoting and maintaining competitive markets and refining compliance auditing. This office combined the rates function of the Office of Pipeline Regulation, the rates function of the Office of Electric Power Regulation, and the Office of Economic Policy, so that analysts now get involved in both gas and electric rate issues and markets since there is more competition between the two markets now.
- **The Office of Administrative Litigation** – The Commission's trial staff consists of lawyers and expert witnesses from the Office of Administrative Litigation. The trial staff participates in cases set for hearing, serving two unique roles. First, it advocates positions for the public interest. Second, trial staff actively leads the settlement process in most cases and routinely explores alternative dispute resolution techniques.
- **The Office of Administrative Law Judges** – The Office of Administrative Law Judges resolves contested cases as directed by the Commission either through impartial hearing and decision or through negotiated settlement. It also presides over ADR procedures at the request of the parties in cases assigned for hearing.
- **The Office of the General Counsel** – The Office of the General Counsel provides legal services to the Commission. OGC represents the Commission in cases before the U.S. Circuit Courts of Appeal and the U.S. Supreme Court and is responsible for the legal phases of the Commission's activities. The Dispute Resolution Service (DRS), which resides under the OGC, fosters the use of alternative dispute resolution processes (ADR)

within the Commission and for disputes within oil, gas, electric, and hydroelectric industry.

- **The Office of the External Affairs** – OEA serves as FERC's primary source of information regarding energy regulatory matters for the general public, federal, state, and local governments, news media, regulated entities, and public and private interest groups.
- **The Office of Strategy and Organizational Management** – OSOM is responsible for defining Commission direction and anticipating and planning for the future. The Office aligns human resources with the Commission's strategic plan and goals and coordinates the processes by which employees are attracted, retained, and developed in order to best support those goals. Additionally, OSOM coordinates management review and change initiatives in accordance with the Commission's strategic direction.
- **The Office of Finance, Accounting, and Operations** – The Office of Finance, Accounting, and Operations oversees and directs the executive and administrative operations of the Commission. It also advises the Chairman of potential issues and concerns in the areas of management studies and related financial reviews, productivity, and performance audits.

3.1.2 Systems

This section provides an overview of systems at FERC that will be involved in the E-filing process. Also included are relevant external systems that interface with FERC. The following information is provided for each system: its purpose/functionality, its program office, system platform and OS, primary applications, and primary interfaces. Applications and communications will be discussed in more detail later in this section.

The systems include:

- **FERC Automatic Management Information System (FAMIS)** – The objective of the FAMIS system is to store all filings from the general public (approved or rejected). It is a system which stores working documents, electronic tasks, and links to other system functions.
- **Records Information Management System (RIMS)** – This system's objective is to store images and documents submitted by the general public and issued by the FERC.

- **Commission Issuance Posting System (CIPS)** – This system is used to provide timely access to issuances of the FERC (e.g., orders, notices, and rulemakings.) The issuances can be read and downloaded in either ASCII or WordPerfect 8. CIPS also provides a daily filing list that contains the FERC reports, citations, and the daily calendars of hearings and meetings.
- **Form Application Systems:** the servers that are used for processing forms, including :
 - Form 1, Electric Utility Annual Report
 - Form 6, Annual Report of Oil Pipeline Companies
 - Form 423, Cost and Quality of Fuels for Electric Plants-Monthly
- **Windows Client Stations:** Windows 95 based computers (version 95a and 95b) are used for specific applications created in Visual Fox Pro, Turbo Pascal, DOS Clipper, etc.
- **IBM RISC 6000:** IBM RS/6000 PowerServer 990 O.S. AIX 4.1.4. is used as the RIMS application and database server.
- **Doorway Server:** Compaq Proliant NT based computer. The public may submit filings to the FERC electronically through the Doorway server.
- **NT Servers:** The following types of NT servers are in use: Compaq Proliant 1500 Server (CIPS Webserver) with a Pentium II processor, 100 MB of RAM, 32 GB hard drive; and Dell PowerEdge 2200 Server (RIMS Web Server) with a Dual 333 MHz Pentium II processors, 128 MB RAM, 9 GB SCSI-3 hard drive.
- **NetWare Servers:** Novell 4.x.
- **Index Server:** Compaq Server. O.S. Windows NT; application: MS Index Server (CIPSWeb).
- **Virus-scanning Server:** The application is McAfee VirusScan that runs on a Compaq Proliant Server, O.S. NT Server 4.0.
- **E-mail System:** FAMIS includes an e-mail system that supports dynamic e-mail groups by team; works with GroupWise v5.5
- **Automatic Number System:** This is a web-base query system running on an NT platform.

3.1.3 Applications

The following paragraphs highlight the primary applications that are involved in electronic filing.

3.1.3.1 FAMIS

The FERC Automated Management Information System (FAMIS) has replaced the mainframe applications: CIS, ACAS and KICTS¹. FAMIS uses the *Open Text Live Link* EDMS/Workflow software. FAMIS is the primary platform used to implement the requirements identified by the *FERC First!* BPR effort. FAMIS is intended to provide the "one-stop-shopping mall" for all FERC-wide data needs. FAMIS incorporates the functionality of the following systems/applications:

- CIS: Commission Issuance System (a mainframe system used to manage, track, and disseminate Commission Issuances in accordance with the mailing and service lists it maintains, following the documents associated with the issuances as they are logged in and out through the registry, printing, and distribution processes.)
- ACAS: Automated Commission Agenda System (a mainframe system used to schedule and maintain the agenda for each public Commission meeting)
- KICKS; Key Indicator Case Tracking System (a mainframe system used to track the Commission's caseload, including the significant milestones for each case or "docket).

Planned system incorporation includes:

- Rate & Tariff Information System (RATIS) & Auto Number Sheet (ANS) systems for support electric transmission tariffs.
- Office of Energy Projects Information Tracking (OEP-IT) system to consolidate the Hydropower annual charges system, the Hydropower License Compliance Tracking System (HLCTS) and similar information on natural gas pipeline projects.

FAMIS also has a "download link" to PeopleSoft to provide updated staff listings.

¹ As identified by the October 1, 1999 document "What to Expect from FERC Automated Systems" all of the functionality of CIS, ACAS and KICTS is presently implemented in FAMIS.

3.1.3.2 RIMS

The Records and Information Management System, illustrated in Exhibit 3-2, is a computerized index of all official documents submitted to and issued by the Commission after November 16, 1981. Access to RIMS is available to the public (and FERC users) via the Internet, and internally to FERC users via the LAN/WAN. Documents from November 1995 to the present can be viewed and printed from FERC's Home Page using the RIMS link or the Energy Information Online icon. Documents from November 1981 through October 1995 are stored on microfilm and can be printed upon request. Scanned documents are initially saved as TIFF images for optical storage but are converted to GIF images for web browser display. Magnetic disk storage uses an EMC Symmetrix 160GB while Optical storage resides on a Cygnet/ATG.

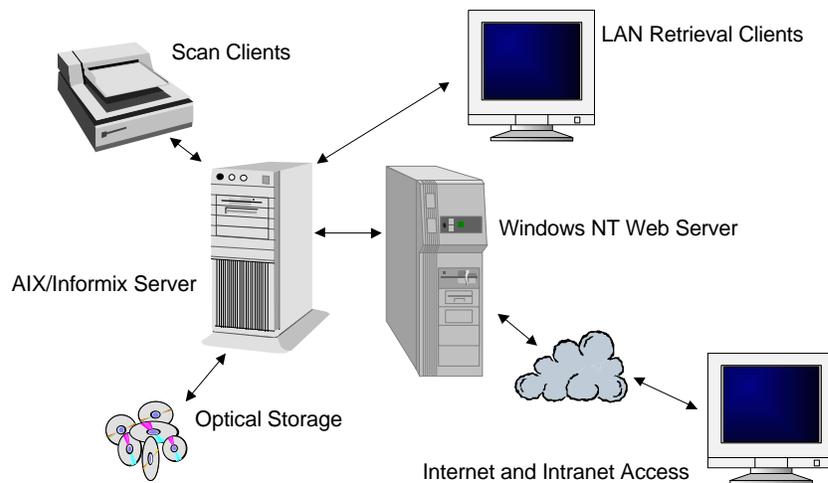


Exhibit 3-2. RIMS System Overview

3.1.3.3 CIPS

Commission Issuance Posting System provides access to the texts of formal documents issued by the FERC since November 14, 1994. Documents are posted in WordPerfect and ASCII formats. CIPS is an X-based database table running Microsoft's Internet Information Server.

3.1.3.4 FASTR

FERC Automated System for Tariff Retrieval (FASTR) is used in the Office of Markets, Tariffs, and rates for receipt, verification, database management, and search and retrieval of natural gas pipeline company tariff sheets submitted in electronic format. The tariffs contained in FASTR are publicly available via the Commission's web site.

3.1.3.5 Docket Sheet and Service List System (DS/SL)

The Commission (Office of the Secretary) assigns a docket number to each proceeding initiated by an applicant, other party, or the Commission. The Docket Sheet lists all submissions and issuances in a particular case or “docket”.

The Office of the Secretary also maintains a list of contacts for all parties that have filed Motions to Intervene in a particular case or “docket”. Each party to a Motion to Intervene may add up to two contacts to the “service list”. When parties to a case make a filing with the Commission, they are required to serve a copy on all other persons on the service list. Similarly, the Commission must serve a copy of its issuances in a case to all parties on the service list for that docket. The Office of the Secretary also maintains service lists for rulemaking proceedings.

The Docket Sheet/Service List System is part of FAMIS and had query capability for daily filing and issuance lists, and the service list for a particular docket.

3.1.3.6 GASIS

GASIS is a repository for information filed with the Commission by natural gas pipelines.

- FERC Form No. 2: Annual Report of Major Natural Gas Companies
- FERC Form No. 2A: Annual Report of Non-Major Natural Gas Companies.
- FERC Form No. 11: Natural Gas Pipeline Company Quarterly Statement of Monthly Data.
- Index of Customers

As a result of Order No. 637, issued February 9, 2000, the Discount Rate Reports will be discontinued September 1, 2000. Order No. 637 will expand the information that natural gas pipelines must file as part of the Index of Customers.

3.1.3.7 FERC Gas Data: Form 2 Admin

Used to support pre-processing of Form 2 & 2a electronic filings prior to loading into FERC Gas Data System. Generated PDF version of filings.

3.1.3.8 FERC Gas Data: Form 2 Validate

To allow Utilities to review and validate their forms prior to submission via the Web.

3.1.3.9 FERC Gas Data: Certificates Processor

Small file-type application utility used to copy Certificates (i.e. files) to network drives.

3.1.3.10 CIPS Manager

CIPS Manager downloads information from CIPS in ASCII format and provides staff with indexing and text search capability across documents.

3.1.3.11 Tracking Systems

The following tracking systems are used within FERC²:

- Litigation Tracking System (LTS): Office of Administrative Litigation (OAL) tracking system for settlement cases and the attorneys, analysts and judges assigned to them.
- General & Administrative Law Tracking System (GALTrack): Office of the General Counsel (OGC), General and Administrative Law case tracking system and notes.
- TRACKER: OMTR tracking system for Rate Applications, Issues related to rates, Technical Conferences, and Budget Code information.
- CERTTRACK: OMTR tracking system for Certificate cases, Issues, Protests, Rehearing and Construction costs related to certificate applications.
- Front Office Tracking System: OMTR system to track milestones for congressional inquiries and front office memos/correspondence.
- EISTrack: Office of Energy Projects (OEP) system to track environmental case processing descriptions and milestones for pipeline certificate casework.

² Of the 85 tracking systems referenced in y2ksyslst.testassess.xls, these are the most important for E-filing.

- Environmental Conditions Tracking System (ECTS): OEP system to track status of environmental conditions and compliance for natural gas pipelines.

3.1.4 Communications

3.1.4.1 LANS

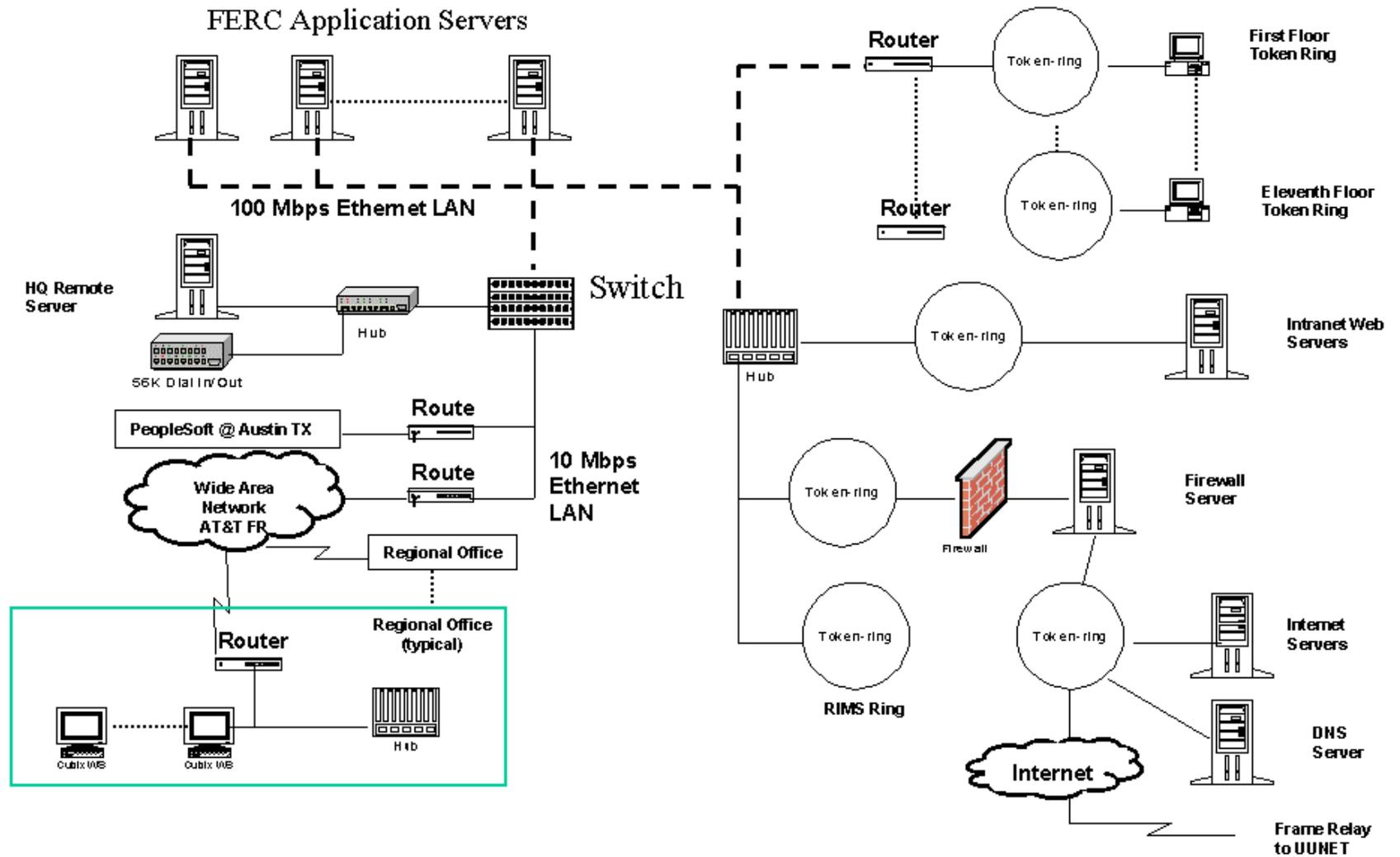
The local area network within FERC consists of both Token Ring and Ethernet. Signal Corporation is transitioning the LAN from Token Ring to a full Ethernet system. The FERC Ethernet Migration will take place using Cisco Catalyst 5000 Series of Ethernet Switches. More specifically the 5505 and 5509 models, along with the existing Synoptic Token Ring 3000 series Hubs. The Cisco Catalyst 5509 Ethernet Switch will be installed at the FERC headquarters while the Cisco Catalyst 5505 will be installed the Regional Offices.

A general illustration is provided below. When completed the system will consist of 100 Mbps Ethernet to the desktop with a 1 Gbps backbone.

3.1.4.2 WANS

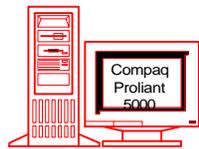
The Wide Area Network, illustrated in Exhibit 3-3, consists of an AT&T Frame Relay system (FTS2001) that connects to the regional offices as well as a separate frame relay to the Internet Service Provider, UUNet.

FERC Infrastructure

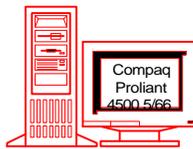


The illustration reflects some organizational codes from the FERC's previous organizational layout. This is currently undergoing changes to update the codes accordingly.

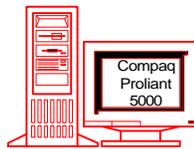
HQ SERVERS



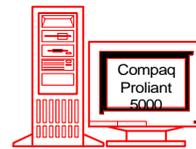
4.11 HQ1
E-Mail



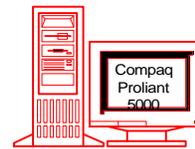
4.11 WDCO2
CO
CH



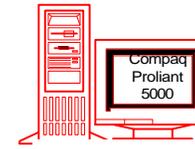
4.11 FERCWIDE
Global Apps Server



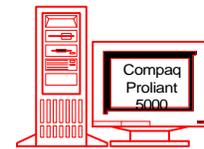
4.11 WDCO4
CI-1
ED-10
ED-11
ED-12
ED-13
ED-14
Signal/(Subs)
LaDorn



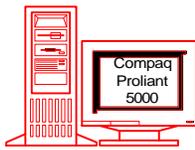
4.11 WDCO5
EA
LJ
HL (HQ)



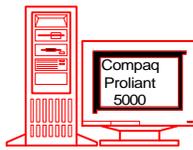
4.11 WDCO6
OSEC
EP
ED-1
ED-20
ED-21
ED-22
ED-24
GC-13
Stay-in-School
RIMS Ops.
Empl. Assist.
Couns.
Health Unit
Fitness Center
Childcare Center



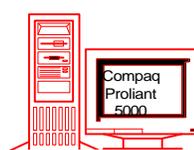
4.11 WDCO7
CA
PR



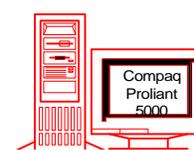
4.11 WDCO8
PR



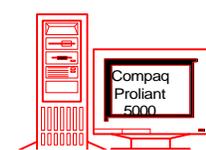
4.11 WDCO9
GC
(except GC-13)



4.11 FERCD
Commission CD Server

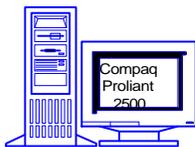


4.11 FERCD_TRAIN
Commission Training Server



4.11 FERCD_APPS
NDS Tree master replication server
Time Reference server
Laser Fiche

REGIONAL OFFICE SERVERS



4.11 ARO1
HL-12.2

Atlanta



4.11 CRO1
HL-12.3

Chicago



4.11 NYRO1
HL-12.4

New York



4.11 PRO1
HL-12.5

Portland



4.11 SFRO1
HL-12.6

San Francisco

3.2 Future Infrastructure

The future infrastructure that will support FERC's electronic filing activities can be one of several basic configurations. These alternatives are discussed in the paragraphs that follow, along with their pros and cons.

3.2.1 Fundamental Architecture Implementation Considerations/Alternatives

3.2.1.1 Maintain Status Quo

Maintaining the status quo is not a practical alternative for a multitude of obvious reasons. FERC is presently improving the regulatory processes by reducing the cost and volume of paper filed by applicants and intervenors. It is anticipated that the volume of work that will be processed will continue to grow due to expanded competition in the energy market.

Additional considerations that prohibit maintaining the status quo include a general requirement for access to data in a timely manner. This has become an expectation brought about by the changing technology available to both FERC and the energy industry. This has resulted in business being conducted in an accelerated manner such that maintaining the status quo would not be a viable alternative.

Our primary customers are demanding electronic filing capability and enhanced electronic retrieval. To effectively regulate in a world driven by electronic communication, transmission, storage and retrieval, an electronic filing and publishing infrastructure must be implemented.

3.2.1.2 Monolithic Alternative

The most common example of a centralized configuration is a mainframe or central server-based system. In this environment all hardware, software, and supporting applications execute on a single host or cluster of servers residing in one location. This configuration incurs fewer system administration and maintenance costs compared with a distributed configuration. This configuration favors functions that can be, or logically should be, centrally located, such as financial systems, human resources systems, and common customer documents and profile databases. Critical issues surrounding this configuration include its data availability, user support, network bandwidth consumption (especially as FERC moves to incorporate more complex data types), and supporting infrastructure requirements. A centralized configuration includes a system to run mission applications and real-time applications, run the RDBMS, process batch jobs, and manage the primary storage subsystem.

The centralized system can also act as a data repository for the enterprise data. Servers may be included to support applications by acting as the interface between the client and back-end data server (e.g., a three-tiered architecture). In FERC's environment, these application servers would use the Windows NT operating system.

The ability to centralize data in a single environment allows database administrators to more easily standardize interfaces and data formats from filers; simplifies the collection and storage of FERC data; and channels FERC analysts' queries to one location. Further, by maintaining a centralized configuration for its data, FERC would reduce its systems maintenance requirements (over a distributed alternative) and reduce the number of stand-alone applications that are interspersed throughout the current environment. Adopting a centralized configuration reduces the amount of data redundancies (inherent in distributed alternatives) within the system and allows for a single data source for all applications.

The risks of a centralized configuration include maintaining a single system configuration capable of delivering acceptable system response times; batch processing impacts on the system (e.g., whether there are enough CPU cycles available to process the batch workload in the allotted time); its potential as a single point of failure (adequate system and communication redundancy would be necessary); scheduled system downtimes and their impact on FERC processing; and configuration expandability limitations. A centralized configuration does offer advantages over a distributed configuration in the areas of security and maintenance. Security within a centralized configuration is easier to implement and control compared with a distributed configuration. Maintenance and data synchronization within a single system environment is much more straightforward than distributing and synchronizing data among many systems.

3.2.1.3 Distributed Alternative

Distributed data configurations are recognized for their modularity, scalability, and relative ease at disseminating data to the desktop level. The architecture supporting these configurations can span large geographic areas or a single floor within an office building. This type of configuration allows IT systems designers to place data and their supporting platforms and software products in strategic locations to best support mission critical functionality. However, it is the most complex of the configuration options to manage and administer.

The distributed configuration uses application servers and local file servers within office locations capable of supporting such an environment. The configuration includes multiple servers to segment the RDBMS workload and run the RDBMS and mission applications.

For the distributed configuration to be deployed, the data currently stored in the enterprise or legacy data stores would have to be converted to the target RDBMS environment and loaded onto the distributed servers. The

RDBMS applications run on the distributed servers, which are designed to handle the appropriate transaction volume and application workloads. A thorough analysis would be needed to determine the load and processing needs for the server to ensure that the servers are sized properly.

To provide for RDBMS transactions, minimal down time, and the ability to scale the system, an operating system needs to be robust and proven within the industry to have successfully addressed these issues. A Unix operating system is the predominant operating system for a distributed RDBMS production environment, although Windows NT versions of RDBMS products are available and are gaining market share with their most recent releases. Data in this configuration must be accessible by all FERC staff and possibly by FERC's clients.

Distributed architectures are typically employed to minimize network traffic, increase performance and responsiveness, provide redundancy for disaster recovery, and enhance the ability to modularly grow an enterprise. Data may be grouped or organized in any manner, regardless of quantity, location, or format. This segmentation of data, such as might be done on a regional basis, can increase performance for query and report generation within that domain. However, it can also complicate report generation if enterprise-wide reports containing data from multiple databases are needed. The configuration's flexibility creates added costs from a systems administration point of view. Distributed configurations tend to be more complex to maintain depending on the amount of data, the way in which it is distributed, and its replication, backup, and recovery requirements.

A distributed configuration would allow FERC to distribute its data to suit program requirements and business functionality. Further, because of their modular nature, distributed architectures adapt and grow well with future technologies. An increasing number of commercial products—including analysis tools, platforms, and operating systems—are being designed to operate in this environment.

Most of FERC's existing applications are centralized (monolithic) by design and will not migrate easily to a distributed configuration. These would be better suited to a centralized data configuration rather than a distributed configuration. This is because much of the data is used by FERC staff located at the Washington, D.C. office, and most of the data is static once received from the responsible parties. However, the Commission's five Regional Offices are also the initial points of receipt for most hydropower dam-safety related filings and reports, and this "distributed" requirement must be included in the architecture.

3.2.1.4 Alternative Evaluation

The evaluation criteria for comparing the four FERC architectures are:

- *Use of standards*: the extent to which the overall architecture and individual system hardware, software, and communications components comply with the applicable standards, including accessibility standards
- *Open systems environment*: the degree to which the FERC configuration permits transparent interoperability and integration among multi-vendor equipment and applications
- *Modularity*: the degree to which individual components (e.g., workstations, communication services, or applications) may be incorporated and independently configured within the architecture
- *Expandability and Upgradability*: the ability of the configuration to support the current and projected data volumes, workloads, workstations, and hosts by expanding, upgrading, or enhancing the baseline component configurations
- *Security*: the degree to which the system and application components provide appropriate security features
- *Processing Capacity*: the ability of the configured processing resources to process the FERC workload
- *Resource Sharing*: the degree to which the architecture permits sharing of local resources (e.g., host resources, file systems, and data)
- *Database Interface Standards*: the degree to which the configuration can support and RDBMS using SQL and the IRDS standards
- *Ease of Implementation*: the ease with which configurations and applications can be deployed relative to manpower, personnel skill levels, and migration and implementation effort duration
- *Hierarchical Storage Management*: the degree to which the architecture facilitates the use of an automated hierarchical storage management system
- *System Management*: the degree to which system administration and management faculties are provided to maintain and operate the system
- *Maintainability*: the degree to which the configuration supports minimization of maintenance requirements, problem isolation, and easily replaced components.

All of the above factors are important in evaluating a potential enterprise architecture. But the most important factors are the first four: the use of standards, provision of an open environment, modularity, and expandability and upgradability. These are important because:

- Standardization simplifies integration.
- An open environment permits vendor-independent solutions and improves competition.
- A single, modular, architecture that is applicable to all FERC users is preferred over multiple, differing solutions supporting special communities of interest and the attendant supportability and integration issues.
- An expandable solution permits incremental deployment of hardware and applications.

In the comparative evaluation of the candidate architectures, each evaluation criterion is rated. The possible ratings include unsatisfactory, satisfactory, or excellent. This will be done as part of the FERC E-Filing Technical Architecture. An unsatisfactory rating indicates that the architecture does not adequately meet the minimum requirements for that criterion in the FERC environment. A satisfactory rating indicates the architecture meets the minimum requirements. An excellent rating indicates the architectural design significantly exceeds the minimum requirements. An excellent rating is assigned based on a subjective technical evaluation of factors that exceed the minimum requirements of a particular criterion, such as additional features or functionality offered by the approach, increased flexibility in the design and expansion of the architecture, or higher performance or reliability.

3.2.2 Client/Server Implementation Considerations/Alternatives

In a client/server software architecture, two processes interact—one as superior and the other as subordinate. The client process initiates requests, and the server responds. Client and server can reside on the same machine, but they typically run on separate machines linked by a network. Data integrity and network bottlenecks top the list of performance concerns for developers deciding whether to locate application processing in the client or in the server and how “thick” or “thin” to make the client portion of the application equation.

Client applications typically present information. Client goals include making information easier to access, assisting end users in organizing specific tasks, hiding complexity, and reducing learning time. Examples of client applications in the FERC environment are applications

implemented using Visual FoxPro, Visual Basic, or browser-based application front-ends that execute on the desktop systems.

Server applications typically manipulate information. Server goals are data oriented. These goals include transaction control, performance optimization, physical-storage management, and ensuring data integrity.

The physical separation of client and server leads to several fundamental constraints on application design. A good design involves finding the correct balance between:

- *Minimizing traffic on the network*: minimize the number and physical size of requests and responses between client and server.
- *Implementing important business rules in services running on the server*: the server can never be circumvented, so this approach ensures data integrity.
- *Offloading as much logic as possible to the client*: the primary two reasons are that it accelerates feedback when the user makes incorrect entries on the client; and second, it reduces the load on the server, which becomes a bottleneck if many clients compete for services.

Problems can arise for many reasons. Placing too much data within a client exposes limitations in desktop backup and recovery procedures. Placing too little data on a client can cause networks to grind to a halt as users ship records or image files between clients and servers. Building many small transactions between the client and server can also generate excess network traffic.

In addition to deciding data location, developers must decide on the location for executing application functions. Putting large amounts of procedural code on a client may give individual users the best response, but may complicate software distribution, configuration management, and trouble-shooting. Storing procedural code as triggers in a relational database is becoming a more popular approach. However, this also poses program maintenance challenges.

Characteristics of client processes include management of the graphical user interface, presentation logic and control, procedural business logic (guiding a user in the correct sequences to execute a business process), local data file input and output, temporary file management, control of functional access, input data validation, data manipulation and calculations, on-line user help, event logging, error recovery, and server session management.

Characteristics of the server process include data logic for record create, read, update, and delete; enforcement of global business rules; file

management; data access control; data integrity; event and transaction logging; error recovery; and multi-client session management.

The functionality of the client layers encompasses:

- Presentation managers, such as Microsoft Windows, that handle keystrokes and mouse clicks. In some cases, input is handled entirely within the presentation manager layer; for example, moving the scroll bar. In other cases, the presentation manager passes a message to the presentation logic for further processing. A 3270 character stream can be considered a very primitive presentation manager. A web browser (e.g., Microsoft's Internet Explorer or Netscape's Navigator) is an example of a very "thin" presentation manager client (i.e., the bulk of the data and business logic processing is performed by the server).
- Presentation logic, which includes navigating among forms, preliminary data validation, managing window objects, and handling presentation error messages. It also includes data formatting and converting from data gathering transactions (queries) into tables, graphs, charts, and other display formats.
- Business, or control, logic—which is a catch-all for processing that is not directly tied to the database or the presentation. This processing includes complex data analysis and manipulation, implementation of business procedures, and directing transactions from the presentation logic to data servers.

The corresponding server layers include:

- Data logic, which implements actions such as read and write transactions involving SQL statements, commits and rollbacks, and database error message handling. Write transactions change system resources and leave the system in a logically and physically consistent state. Read transactions are not as well defined. They can be defined narrowly—as the creation of SQL views, or more broadly—as the generation of summary information from the database.
- Data managers, such as network file servers, legacy and relational database managers, and object-oriented systems present a range of APIs to the data-logic layer, from primitive (file server) to sophisticated (object-oriented and extended relational systems). As data managers become more sophisticated, less code is needed in the data logic layer.

Requests and responses passing among these layers are called events. Each layer accepts events from above and—in the course of executing actions—generates internal and external events. External events are

directed to the layer immediately above or below; in a true client/server architecture, events directed from a lower level to a higher level are, by definition, responses to outstanding requests. Figure 4-5 illustrates the type of events passed among client/server layers. For example, the presentation manager directs error messages and status information to the user in response to keyboard and mouse actions. The data manager directs query results to the data logic in response to SQL statements.

Examples of events directed from a higher level to a lower level include:

- From user to presentation manager, events are keystrokes and mouse movements and clicks.
- From presentation manager to presentation logic, events are procedure calls in the application programming interface that carry new data and control inputs.
- From presentation logic to business or control logic, events are functional (business) requests.
- From business logic to data logic, events are transactions.
- From data logic to data manager, events are SQL statements.

Viewed this way, the layer acts as a filter. Within the client, filters successively concentrate many detailed events into fewer, more significant events. Between client and server, each event is equivalent to a business transaction. Within the server, the filters successively expand events into SQL statements and low-level database access commands. This approach minimizes traffic on the wire and simplifies the critical interface between client and server.

3.2.3 Storage Implementation Considerations/Alternatives

3.2.3.1 Data Retention Requirements

Data retention and data accessibility can be addressed together. Data retention indicates the length of time a particular data set must be retained. For legal reasons, FERC must retain much information for years after the initial filing. Some letters generated to a customer may need to be retained for only as long as it takes to generate and print a copy of them; a record of the type of letter and date sent might be sufficient. The National Archives and Records Administration (NARA) requires that the Commission establish record retention schedules for all official agency records. (See Appendix C). The requirement applies to both paper and electronic records. The Commission must be able to destroy records at the end of the applicable period specified in the Records Retention Schedule. In some cases, records must be retained for

more than 50 years (e.g. hydro licensing related documents). Another concern is the availability of applications in the native application formats up to 50 years from now. As a consequence, a long-term program for electronic record keeping must be considered. The longer the data must be retained, the larger the data store grows.

In conjunction with data retention requirements, data accessibility addresses the speed with which a data set must be accessed. Requirements can span between sub-second response times to overnight batch staging of data, depending on the particular business requirements. These requirements drive the choice of storage location and media for the data. In terms of retrieval speed, retrieval from local magnetic storage is quickest. Other storage areas, in order of fastest to slowest retrieval speed, include LAN-attached storage (i.e., file server) or a host's magnetic disk storage, optical storage, or magnetic tape. Magnetic storage is typically referred to as on-line storage. Optical storage (e.g., jukeboxes) or automated magnetic tape library systems are referred to as near-line storage because media can be automatically loaded upon request without human intervention. Magnetic tape or optical platters sitting on a shelf are off-line storage. They must be physically inserted into a drive by a system operator.

Therefore, a combination of retention, accessibility, and protection requirements will dictate the location at which data is stored in the overall architecture. Hierarchical storage management systems aid in migrating stored data to less expensive, but slower, storage media as it ages and is accessed less frequently. Hierarchical storage management can also be implemented using system administration procedures to move data from one storage medium to another.

3.2.3.2 Media Alternatives

The Commission must retain official records in a format that accurately renders a document for the duration of the retention period. For paper records, scanned image formats always reproduce the document As-filed. For electronic submissions, the ability to render a document As-filed may be hindered by the proprietary software application used to create the electronic submission.

3.2.3.3 Storage Management

Accurate user requirements and data characteristics are important factors in designing data stores for FERC applications and in making decisions about storage location and access. The hierarchy of available data storage locations includes the FERC centralized systems, LAN file servers, and networked workstations. Data storage technologies at each location consist of three levels: main memory, magnetic disks and disk arrays, and tapes and optical disks. Each successive level offers lower cost and slower access rates but much higher storage capacity.

General industry surveys indicate that up to 80 percent of data stored on file servers is rarely, if ever, used again. Easier access to shared storage adds to the growing file storage capacity requirements. In addition, the introduction of text search and retrieval and image-enabled applications can quickly consume vast amounts of storage. Consequently, automated storage management systems may be necessary to distribute data to faster or slower storage devices when dealing with large amounts of on-line data.

Hierarchical storage management (as a business process) simplifies the process of storing, managing, and accessing data. The explosion in data volumes and the proliferation of microcomputers and networks has forced vendors of storage technologies to redefine data management. HSM allows system managers to streamline the storage environment through hardware that positions data based on frequency of access. Many vendors offer products that prioritize data according to user needs and the cost of storage media. The most vital data is kept on-line, while different levels of archiving define what is stored off-line.

Near-line is an industry term for an intermediate category of storage that uses optical storage technologies such as CD-ROM or optical jukeboxes and improves the efficiency of cartridge-tape management by using robotic handling. Near-line storage has improved the efficiency of data processing operations and substantially lowered the overall cost of storage for optical disk and cartridge tape users. By coupling the robotic handling of platters or tape cartridges with the speed of the drives, data processing installations can maintain a class of service that falls between on-line and off-line. Optical storage devices using jukebox technology can store massive amounts of information on readily accessible high-density platters. Competition is fierce in the storage area network market as technological advances continue to increase storage densities and drive the cost per gigabyte lower and lower. Near-line storage offers the cost-effectiveness of removable media without the lower performance of manual operation.

Tape is the most widely used medium for off-line long-term mass storage, but optical disk is receiving increasing attention although costs still are generally higher for disk than for tape. Optical disk is good for storing bulk data that must be kept available but is not time critical, and is far less expensive than magnetic disk. Its weakness is that access time is slower; newer drives, however, continue to provide faster access speeds. Its strengths are that it is incredibly dense in terms of the amount of data that can be stored, and it has a longer shelf life than its magnetic counterparts.

The goal of system managers is to maintain a balance between storage responsiveness and cost-effectiveness. It is not enough to allocate space for inactive files; the files must be positioned on the appropriate media while remaining accessible. Inactive files may be continually transferred to slower, cheaper media. HSM balances active files remaining on high-

performance storage media with less active files automatically moved to more cost-efficient storage. Upon request for an archived file, hierarchical storage managers automatically restore the requested file onto active media. This ability to transparently migrate files up and down the hierarchy based on usage is becoming increasingly attractive to system designers and administrators. But because HSM systems are designed to move files, not portions of files, their use with applications involving very large databases must be carefully examined.

Integrated storage servers combine tape, optical disks and magnetic disks with hierarchical file-server software. Vendors of integrated storage servers say their products automate data backup and archiving, store infrequently needed data on the least-expensive medium, and make frequently needed data available quickly anywhere on an enterprise network.

3.2.4 Security Implementation Considerations/Alternatives

3.2.4.1 Security Requirements

The Commission must comply with the Privacy Act of 1974. The purpose for an information request should be provided anytime the public provides or enters data. The public should be given the right to choose whether or not to provide information. When information is used for other purposes or those other than originally intended, a privacy notice should be provided. In addition, privacy information maintained by FERC will be properly secured.

In addition, regulated companies need to protect proprietary information. The FERC must ensure that all electronic submissions containing sensitive information are transmitted and stored in a secure manner. Furthermore, the FERC must provide the industry with defined procedures for filing, receiving, and posting documents of mixed proprietary and non-proprietary content.

3.2.4.2 Levels of Security

Information security is a broad topic, from both a policy and a technology perspective. One of the key objectives of the overall architecture is to facilitate information sharing within FERC and with its customers. When interoperability between FERC and its customers is being considered, a host of challenges arise to achieving the required levels of confidentiality, integrity, availability, and non-repudiation. The computer systems that reside within the FERC facilities will provide proper levels of security from an internal perspective. However, it cannot be presumed that the industry's computer architecture will provide for proper levels of security. As an example, the Windows 9x family of desktop operating systems should be viewed primarily as a workstation/personal computer application environment and graphical

user interface that does not provide authentication or access control features suitable for the protection proprietary or privacy-sensitive information. Since most of the industry utilizes the Windows platform it is necessary to require that appropriate levels of authentication be required for any electronic filing requirements. FERC will need to ensure that firewalls are in place to prevent unauthorized access to FERC information. FERC will also need to work with regulated entities to determine what type of information is considered proprietary and therefore should have limited access by the public and other regulated entities.

These challenges and their solutions involve technical, policy, administrative, and procedural issues. The technical issues can be readily addressed using appropriately configured and integrated commercial products. Policy and procedures must be instituted via appropriate directives, guidelines, training, and sustained enforcement.

The services that represent the basic building blocks of secure interoperability are:

1. *User Authentication* – A security measure designed to establish the validity of the originator, or a means of verifying an individual’s authorization to receive specific information.
2. *Confidentiality* – Assurance that information is not disclosed to unauthorized persons, processes, or devices.
3. *Data Origin Authentication* – A security measure designed to establish the validity of a transmission or message.
4. *Data Integrity* – Condition existing when data is unchanged from its source and has not been accidentally or maliciously modified, altered, or destroyed.
5. *Non-repudiation* – Assurance the sender of data is provided with proof of delivery and the recipient is provided with proof of the sender’s identity, so neither can later deny having processed the data.
6. *Availability* – Assurance that adding the interfaces required to allow the sharing of information will not create situations in which authorized users are denied service.

A fundamental prerequisite to information sharing is trust between parties and agreement on access and protection mechanisms. The security interoperability model must provide a logical progression for implementing secure information exchange and a framework for positioning infrastructure and technology requirements. Sharing data among applications within the FERC internal domain is a simple example illustrating a situation in which data stored in systems of similar

security levels are being shared. Sharing data between systems of differing security levels, such as might occur when allowing customers access to on-line FERC data or systems, requires additional technological mechanisms.

The technical security services needed by FERC must rely on standards-based technology to support viable interfaces to external customers. The technologies that implement these services include (1) identification and authentication (I&A) management; (2) cryptography; (3) digital signature and key management (i.e., Public Key Infrastructure, or PKI); (4) firewalls, routers, gateways, and guards; and (5) virtual private networks (VPNs).

3.2.5 Information Exchange Implementation Considerations/Alternatives

The Government Paperwork Elimination Act (GPEA), which takes effect in FY 2004, provides a strong impetus for agencies to develop the capability of managing records electronically for their full legal retention period. Under the GPEA (Pub. L. 105-277), by October 2003, agencies must give persons and entities that are required to maintain, submit, or disclose information to the Federal Government the option of doing so electronically when practicable as a substitute for paper, and to use electronic authentication (electronic signature) methods to verify the identity of the sender and the integrity of electronic content.³

GPEA further provides that electronic records submitted or maintained in accordance with procedures developed under this title, or electronic signatures or other forms of electronic authentication used in accordance with such procedures, shall not be denied legal effect, validity, or enforceability because such records are in electronic form. (GPEA, section 1707).

³ From NARA document: <http://www.nara.gov/records/policy/b2000-02.html>

3.2.5.1 Format Alternatives

File Type (Extension)	Creating the File	Formatting the File	Viewing the File	Editing the File	File Sizes
Word 6.0 or other word-processing software (.doc)	Requires proprietary software (Word 6.0);	Requires proprietary software (Word 6.0); Wide array of formatting options that are maintained when files are transferred	Must be downloaded before viewed or modified, unless the Word Viewer is installed	Easy to edit once downloaded; Formatting is mostly maintained; Font changes across various platforms can cause problems with formatting; Requires proprietary software (Word 6.0);	File sizes tend toward the heavy size
Word Perfect 8.0 (.wpd)	Requires proprietary software (WordPerfect)	Requires proprietary software (WordPerfect 8.0); Wide array of formatting options that are maintained when files are transferred	Must be downloaded before viewed or modified.	Easy to edit once downloaded; Formatting is mostly maintained; Font changes across various platforms can cause problems with formatting; Requires proprietary software (WordPerfect 8.0);	File sizes tend toward the heavy size
HTML (.html, .htm)	Requires a basic understanding of HTML, a text editor, or software	Requires a basic understanding of HTML, a text editor, or software; basic formatting options are available in HTML 3.2	Requires any browser and can be viewed immediately on screen or online - access is immediate	Requires a basic understanding of HTML, a text editor, or software	File sizes tend to be on the lighter side - quickly downloaded
Portable Document Format (.pdf)	Postscript files are created in any software, e.g. Microsoft Word, Adobe Photoshop, Microsoft Excel and converted into the PDF format by means of Distiller or PDFWriter; also hard copy can be scanned and converted to PDF using Acrobat Capture	Preserves formatting	Bytestreaming also allows direct viewing online with the use of Acrobat Reader or Exchange; Otherwise, files must be downloaded and opened in Acrobat Reader or in Acrobat Exchange	Minor editing is permitted with the aid of Acrobat Exchange, e.g. addition of notes, addition of links, page cropping	Significantly smaller file size when created from an electronic source
ASCII Text File (.txt)	Any text editor	Limited formatting options - no font options, text alignment options, etc.	Can be viewed directly online through most browsers- immediate access	Any text editor can make editions	File sizes tend to be on the light side

3.2.5.2 Transferring Files

The ability to exchange electronic data easily is critical to the success of an open architecture and FERC's electronic filing initiative. Data exchange may occur by several methods, including:

- Application-to-application data exchanges
- Intra- and inter-site electronic mail among FERC system users
- Sharing of files using a network file server
- File transfer utilities
- Use of windowed applications or terminal emulators capable of capturing session data
- Exchange of data on common portable media such as diskette, CD-ROM, or magnetic tape
- Exchange of data among heterogeneous databases.

Application-to-application data exchanges can be transparent to the user or a can be a direct result of user-directed action. For example, in client/server environments that use TCP/IP as the underlying communication protocol, application processes typically establish sessions with one another using TCP/IP sockets to exchange data. EDI is another example of applications that use a standard method for peer-to-peer data transfer.

Electronic mail offers a relatively straightforward way for users and applications to send and receive information. Many commercial products rely on proprietary message formats and protocols but offer format conversions or gateways for standardized mail exchange. These standards include the International Telecommunications Union (ITU), Telecommunication Standardization Sector, formerly known as the International Telegraph and Telephone Consultative Committee's (CCITT), X.400 Message Handling Systems (X.400, X.401, X.405, X.410, X.411, and X.420), the X.500 Directory Services, and the SMTP and MIME standards.

Network file servers can provide shared file access to LAN-attached personal computer users. System administrators can assign directory access permissions to control directory and file access. To the user, the file server simply appears as another disk. Redirectors are used to forward requests for remote files to the file server.

Data exchange in the form of file transfers would use the File Transfer Protocol with TCP/IP. This standard permits systems using the corresponding protocols to transfer files reliably.

Many personal computer applications in the MS-Windows environment allow copying data from one window to another, while terminal emulation packages support the ability to capture interactive session data

to a local file. The data, stored as simple ASCII text, may then be imported into word processing, spreadsheet, or database applications for further manipulation.

Using removable media to exchange information may not be “high tech,” but it is another method for sharing data. Removable media includes diskettes, removable hard disks, magnetic tape, optical disks, and CD-ROM disks. For some organizations with low-frequency distribution needs, it has proven more cost-effective to make distribution media and mail it to customers or remote sites than to maintain an extensive, infrequently used WAN for electronic distribution of files and data.

To make exchanged data useful to the recipient, the receiving application must be able to recognize and input the data. This requires the use of standardized file formats augmented by widely accepted de facto industry-standard file formats. A file format that has been defined by independent standardization committee is the Open Document Architecture/Open Document Interchange Format (ODA/ODIF). Federal standards for document interchange are also available. These include the standard generalized markup language (SGML under Federal Information Processing Standard Publication 152 (FIPS PUB 152)), vector graphics data (CGM under FIPS PUB 128), raster graphics data (Type I under FIPS PUB 152), and the Initial Graphics Exchange Specification (IGES). Other applicable standards include TIFF, HTML, JPEG, and CCITT Group 3 (facsimile). PDF, although proprietary, is another popular format in which to exchange files.

An additional method of data exchange includes extracting data from databases to obtain necessary data or exchange data between heterogeneous databases. Database management systems maintain a dynamic store of data accessible by all types of applications. The Structured Query Language (SQL) standard (FIPS PUB 127-2) specifies a database interface language used to access database information. SQL, used in conjunction with ODBC, can be used to extract information from one database into another database, or into a file that is then imported into another database. Of course, database replication and synchronization are also possible through features of the DBMS within a particular COTS product line. In addition, the Information Resource Dictionary System standard (IRDS specified by FIPS PUB 156) identifies interfaces to database dictionaries.

3.2.6 Document Management

This section outlines document management vendors that provide products relevant to the E-filing initiative. These have been identified by reviewing the present and proposed products available from market leaders in the document management arena.

3.2.6.1 Adobe

Adobe has long been recognized as the market leader in the printing industry and of recent years has broadened its' market focus to include portable documents that can be distributed via the Internet.

The Portable Document Format (PDF) is a recognized industry format and has recently been accepted by the U.S. courts as the approved format for electronic file submission. The PDF standard is specified in "The Portable Document Format Reference Manual" by Adobe Systems, Inc., Addison-Wesley Publishing Co., 1993, ISBN 0-201-62628-4. More recent extensions to the technical specification are published electronically via the Internet at <http://www.adobe.com>. An inter-agency group within the federal government has recommended that the National Institute of Standards and Technology (NIST) develop a Federal Information Processing Standard (FIPS) based on the published PDF specification.

The latest version of Adobe Acrobat also supports interactive, fill-in forms, with PDF-based format for data that can be imported, exported, transmitted, and received from the Web.

3.2.6.2 Documentum

Documentum AutoRender is an automation server that generates Acrobat Portable Document Format (PDF) and HTML renditions of content stored in the Documentum repository. This makes it easy to create PDF and HTML renditions of content that can be viewed using Web browsers or other PDF viewing tools. AutoRender lets you take full advantage of PDF's portability, annotation capability, searching, and easy access to distribute content for review, approval, and final release. Because the transformation is fully automated, documents no longer need to be converted to Web formats manually.

3.2.6.3 OpenText

OpenText provides complete solutions supporting electronic filing, document management and records retention. The product *Livelink PDF Forms Professional* includes a standard PDF Forms module *plus eForm Warehouse*, a product developed by Cardiff Software specifically for Livelink. The *eForm Warehouse* product extends and enhances the capabilities of the Livelink PDF Forms module by offering point-and-click form design, server-side data verification, and a form processing system. These forms can then be integrated with the workflow management process also supported by Livelink. Form data can be extracted for transfer to external databases, XML, or other applications. Completed forms can be indexed and searched. Features include:

- point-and-click form template design with automated JavaScripting

- server-side data verification
- form processing system
- integration with Livelink Workflow
- extraction and reuse of submitted data via external ODBC databases or XML
- archiving of submitted forms in Livelink
- ability to capture paper forms
- store them as PDF or TIFF documents in Livelink.

3.2.6.4 Cardiff Software Inc.

Cardiff's product, *TELEform*, can handle any kind of form, whether paper or a "digital" format such as a fax, a PDF file, an HTML file, or an e-mail attachment. The product also supports output to PDF, TIFF as well as XML. The XML format which can be exported to other systems including e-commerce, e-business, and server applications. These forms do not require special software development. Forms can be saved directly to FoxPro or other database formats. Cardiff has a partnership with both Adobe and OpenText. The Cardiff product, PDF+Forms, works directly with OpenText's Livelink.

3.2.6.5 Provenance

Primarily focused on Records Management and Document Retention. The primary product, *ForeMost Enterprise*, provides an advanced 3-Tier, 32-Bit architecture for records management.

ForeMost Enterprise has a seamlessly integrated Web Edition offering a complete records package with web- based thin client functionality.

- **Web Access:** Remote users can access the *ForeMost Enterprise* database using Netscape Navigator or Microsoft Internet Explorer. This web access eliminates the need to perform DBMS client installations.
- **Document Viewing:** *ForeMost Enterprise's Web Edition* includes powerful, ActiveX viewing to view over 150 document types. The Active X viewer allows users to view documents in their original format, eliminating the need to install multiple applications on their desktops.
- **Audit Trails:** *ForeMost Enterprise's Web Edition* incorporates a comprehensive auditing system. Audit trails can be generated on Files, Documents, Users and System operations. *ForeMost Enterprise's Web Edition* audit trails provide legal proof of official records activity.

3.2.6.6 Tower Software

TOWER Software's product, *TRIM Captura*[™] is an Electronic Recordkeeping system designed to provide a complete and seamless management solution for physical and electronic documents.

TRIM enables the capture and management of all important documents at the point of creation. Through TRIM's tight integration with Microsoft and other office suite desktop applications, all forms of electronic documents (including email) can be easily captured, indexed and subsequently accessed.

3.2.6.7 Hummingbird

CyberDOCS®, a Web-enabled document management product, provides full document management functionality from a web browser over a corporate intranet, extranet, or the Internet. Features include:

- Web browser interface
- Check-in/Check-out from a Web browser
- New document creation
- Java-based DOCS Open forms interpreter
- Searching across multiple DOCS Open libraries
- Use of standard Internet technology (HTML, Java, Java applets, JavaScript, ASP)
- Complete customization
- Projects and Quick Searches for web browser user
- Seven levels of security

3.2.6.8 FileNET

FileNET provides a variety of products under the heading of "Panagon". The following products are available:

- Web Services: Core product and development environment that integrates with each of the Panagon products to help you build Web-centric eBusiness applications.
- Capture Desktop: Acquires digital and paper-based content into Content Services and your Web servers.
- Capture Professional: Acquires digital and paper-based content into Image Services for enterprise-wide use.
- Content Services: The digital content server that manages dynamic electronic documents throughout their lifecycle, from collaborative creation to secure delivery to revision and re-use.

- **Web Publisher:** Breakthrough product providing indexing and automatic formatting for documents your authors simply drag and drop to your Panagon Web site repository.
- **Image Services:** The high-volume digital image server for storing, retrieving, and managing transactional content and objects of all types.
- **Report Manager:** Specialized software to store, access, mine and analyze computer-generated reports, statements and forms.
- **Visual WorkFlo:** High transaction eProcess software enabling customers, partners, and internal users to automate and drive critical business activities and personalized content creation.

Section 4 – E-Filing Information Technology Architecture

The Information Technology Architecture (ITA) is centered around a Technical Reference Model (TRM) that is built upon the concept of three layered infrastructures: the information infrastructure, the communication infrastructure, and the processing infrastructure. The security infrastructure is a connection mechanism that spans the layers. This is illustrated in Exhibit 4-1.

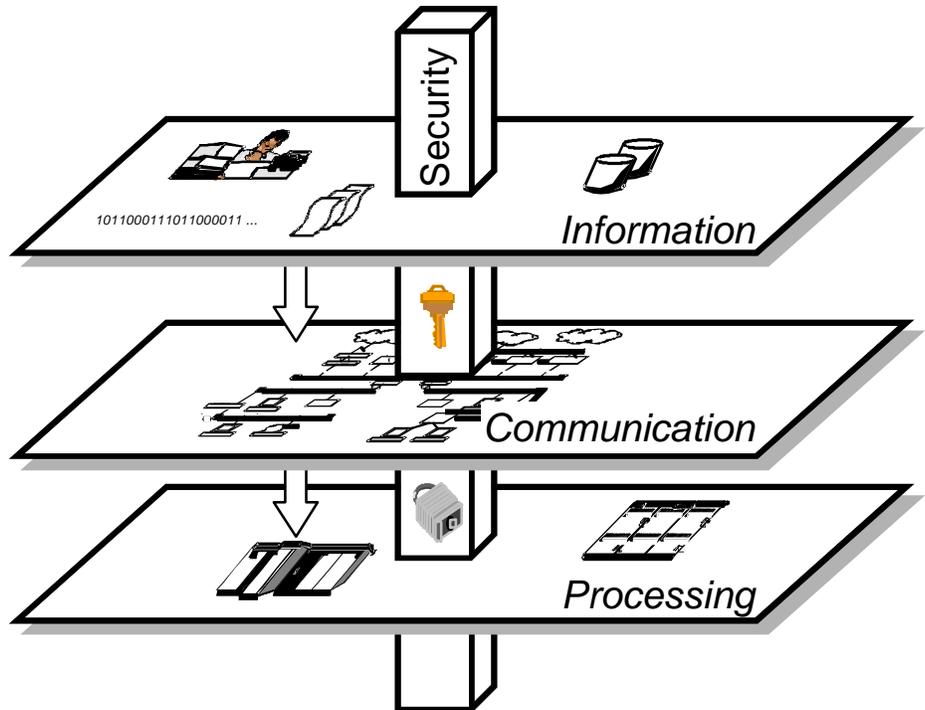


Exhibit 4-1: Technical Reference Model

These infrastructures support a suite of fundamental ITA services (i.e., E-filing functional requirements), and each service is supported by ITA standards, design guidelines, and preferred approaches or products. The infrastructures are explained further in the following paragraphs. Associated standards are presented in Section 4.5.

4.1 Information Infrastructure

The users of E-filing applications are concerned with collecting, saving, sharing, and retrieving information easily and expeditiously. Consequently, the information used and generated is an important aspect of the architecture.

Users' daily responsibilities depend on the information, which exists in a variety of forms, not on the nuances of the technology and its configuration. This intricate information base, taken as a whole, represents the Commission's "information infrastructure." The information infrastructure characterizes the type of information used within the Department: it shows who needs the information and how it is generated, accessed, and maintained. It defines data, models data relationships, facilitates storage and retrieval of data, and describes the constraints on the use of data. This knowledge is then used to develop a technology strategy for efficiently managing the needed data.

The information infrastructure is supported by a diverse suite of application servers, and it provides value through its use of common data format and exchange standards. Well-defined data and data relationships are essential to a secure and interoperable information infrastructure.

4.2 Communications Infrastructure

The communication infrastructure provides the IT connectivity that allows the FERC to share information effectively between systems that are involved in E-filing. The communication infrastructure uses standard protocols and COTS equipment to facilitate data exchange within the FERC and between the Commission and Industry. It consists of the data communication equipment, software, and networks that link computers and peripherals within and between offices. The communication infrastructure provides:

- Pipelines for information movement
- Management of pipelines
- Protocols for information movement
- Mechanisms for information movement through pipelines
- Mechanisms for detecting network faults and failures
- Mechanisms for linking with other networks.

The communication infrastructure is designed in the context of three functional objectives:

- **Connectivity:** It must be able to interface to current and anticipated processing equipment within the Commission.
- **Interoperability:** It must provide mechanisms that permit hardware from competing vendors to communicate, implementing an open system design that allows independence and flexibility.
- **Scalability:** It must be configurable to support the required range of user community sizes, traffic requirements, and unique topologies.

4.3 Processing Infrastructure

The processing infrastructure supports the information and communication infrastructures by providing the computer systems and software necessary to support the FERC's E-filing business needs. The computer systems range from desktop systems to dedicated servers. The processing infrastructure provides mechanisms for:

- Computing, comparing, selecting, evaluating
- Moving information
- Managing user interfaces
- Displaying multimedia information
- Managing processing hardware and software
- Managing system processes
- Controlling system usage.

Functional servers provide specialized services and may take the form of a remote access server, electronic mail server (e.g. LISTSERV), electronic mail gateway, fax server, dial-in/dial-out server, remote LAN access server, database server, text search and retrieval server, or image server. The server software includes COTS packages and applications developed specifically to address Commission needs.

4.4 Security Infrastructure

IT security covers a broad spectrum of operational and policy issues. The E-filing ITA security services comprise the requirements, policies, and practices to secure information sharing. The security infrastructure:

- Safeguards resources
- Supervises resource sharing
- Facilitates digital signatures
- Ensures resource availability to authorized users
- Ensures denial of service to unauthorized users
- Detects and reports intrusion attempts by unauthorized users.

A fundamental prerequisite to information sharing is trust between parties and an agreement on access and protection mechanisms. Given an understanding between the FERC and industry at the policy and practice levels, an IT architecture can be implemented in which trust and secure interoperability are established.

The four levels of secure interoperability defined by the architecture organize the security infrastructure and technology into a single, mission-related framework:

- Basic - Ability to support simple security protocol exchanges between similar security mechanisms. Secure, ad hoc information exchange procedures are developed to support specific FERC-industry information exchanges.
- Intermediate - Ability of systems to exchange and process complex file formats using heterogeneous products. The products consist of items such as simple enterprise data encryption systems, single certificate authority trees, and certificate management protocols. The intermediate level can be implemented by establishing a trusted system between the FERC and one or more regulated entities.
- Advanced - Security systems that are partially interconnected and allow users from FERC and Industry to directly access the other's information systems.
- Universal - The ultimate goal of security infrastructures for achieving interoperability. At this level, security information is shared globally through a distributed information architecture in which applications and systems operate across organizational boundaries and across all security domains. Note, however, that because the standards and products in the IT security are still maturing, achieving the universal level of security cannot be realistically expected in the near future.

Today, the FERC operates at the basic level—establishing ad hoc security and information sharing policies and procedures for projects like the E-Filing Pilot. To meet current E-filing goals and objectives, the FERC will require an Intermediate level of security. Secure transmission of data and robust digital signatures will require established, trusted systems between the FERC and Industry. As E-filing evolves and the FERC strives for increased interoperability with Industry, the advanced level of security will be necessary.

4.5 Standards Overview

Developers have often turned away from comprehensive systems strategies and purchased products or services to satisfy immediate needs, rationalizing that technology and its relevance to mission performance is changing so rapidly that long-term commitments are no longer possible. In the short term, there may be benefits in not establishing an architecture; but, over time, cost efficiencies will diminish and it will become increasingly difficult to leverage existing resources and manage the multitude of system configurations. A well-designed architecture takes into account the need to deliver business value today and the need to put a solid foundation into place that can support tomorrow's multiple systems and information needs.

The Technical Reference Model is built using the concept of four infrastructures: the information infrastructure, communication infrastructure, processing infrastructure, and security infrastructure. The standards presented later in this section are organized around these infrastructures.

The transition to a standard architecture forces the Commission to make many difficult choices among products and technologies, implementation plans, and development practices and policies. A standard architecture reduces the complexity of the computing environment by promoting consistency among applications and data and reducing the number of redundant products used in it. It also helps to focus the expertise of developers and management onto a smaller set of technologies, thereby reducing implementation risk because many integration and interoperability issues will have been addressed before the standard or product is adopted by the E-Filing ITA.

Central to the definition of an architecture is the identification and use of standards. Standardization fosters an environment in which the FERC, the public, and the regulated entities benefit. Selection and adoption of appropriate standards will greatly simplify integration and maintenance requirements and improve the Commission's access to emerging technologies. Because the FERC's environment currently relies on equipment from multiple the architecture must be based upon a suite of widely supported industry and Federal Information Processing Publications standards to promote interoperability.

The Technical Reference Model promotes the use of products and solutions based on industry-derived de facto standards, and preferably on standards developed and ratified by nationally or internationally recognized standards bodies, such as the American National Standards Institute (ANSI), the Institute of Electrical and Electronics Engineers (IEEE), the International Standards Organization (ISO), and the International Telecommunications Union (ITU). Specifications developed by the Internet Activity Board (IAB) and the Internet Engineering Task Force (IETF) can also provide the basis for standards-based implementations of protocol technologies. These products must be highly interoperable, open, and well-supported across platforms and vendors, and they must facilitate interoperability within and between the FERC and its partners. These products must also be highly flexible and scalable to support existing applications and readily accommodate new ones. Except in rare cases, proprietary products have limited strategic benefit to the Commission, and these products defy the spirit of the ITA. These products should be transitioned, as opportunities are presented, to more open and interoperable products.

Much of the functionality and operational benefit presented to users by automated systems depends on the user's ability to transparently interact and exchange information with other systems and users. Because this is so important, standards and configurations that promote an open systems

environment must be carefully selected. Products and designs conforming to such standards can then be used to construct the integrated applications and networks required by E-filing.

The following sections identify the recommended ITA Technical Reference Model standards. They are organized by functional need within each infrastructure layer: information, communication, processing, and security. As technologies change, the standards identified with the ITA will also change. The intent is to identify proven mainstream standards upon which scalable systems and applications can be built. In using these standards, a project team must first evaluate its functional, operational, and support requirements and then determine which ITA standards apply. (Section 4.6 discusses how the Technical Reference Model is kept up to date as standards, missions, and functional needs evolve and how the TRM is used in the project review process.)

The standards tables presented in Sections 4.5.2 through 4.5.5 include products. In some cases, the products comply with the indicated standard and are currently in use within the Commission. In other cases, an independent standard does not exist, and the ITA adopts a product standard for the indicated service. Although the ITA does not mandate a particular product selection, common products within an enterprise simplify design and integration efforts; provide a basis for cost-effective licensing, training, and technical support; and facilitate system administration and maintenance.

4.5.1 Overview

This section provides an integrated summary of the E-filing ITA standards, focusing on standards that are architecturally significant—standards that define a specific technological approach to an E-filing functional requirement. The analysis in this section describes how the standards, as a group, form an overall, high-level strategy for the E-filing ITA. In particular, it considers:

- How the recommended standards align with current industry and technology trends
- How standards in different service areas interrelate to form an integrated framework
- How the standards recommendations fit against E-filing objectives.

The ITA does not define a specific implementation; it provides a framework for building software and hardware systems to support E-filing. The ITA is flexible enough to allow implementers to follow many design paths and still comply with the architectural model. Because the

selection criteria applied in formulating the ITA standards align with FERC goals and objectives, a strategy emerges when considering the standards as a whole.

4.5.2 Information Infrastructure Standards

Information exchange standards address format, interchange protocols, directory, and video teleconferencing services.

Information Format

An objective of the TRM is to reduce the number of standards wherever possible. This strategy generally results in easier integration and interoperability with a reduced operations cost. One of the fundamental purposes of data interchange is to support the transfer of information both internal and external to FERC. This necessitates supporting a number of different formats. By supporting many of the mainstream data format standards, this interchange will be possible with a wide variety of external systems and organizations, without overburdening these systems and organizations with the requirement to translate to a prescribed format.

The focus in recommending multimedia standards (e.g., MPEG, TIFF, GIF, and JPEG) was compliance with commonly used Internet standards. This is an example of intentional overlap in some of the ITA standards. For example, GIF and JPEG are both used to describe a graphical object and both are in common use, so it makes sense for FERC to accept data in both formats¹.

Information interchange also includes document format standards. Standardized document formats are essential to FERC because documents are presently referenced by page number. The dilemma is that there are no true vendor-independent standards for document formats. A large percentage of documents throughout the Industry are prepared in Corel WordPerfect or Microsoft Word formats, both of which are proprietary formats. The Information Technology Architecture includes a reasonably open standard in this area: Portable Document Format (PDF). The PDF file specification was developed by Adobe Inc. and released as a standard. It has become a widely used de facto industry standard that provides good exchange qualities while providing platform-independence; the viewing software is available free of charge and does not require the recipient to have the native word processing package to

¹ For additional discussion on GIF, see: 2.4.3.21 Digital Pictures

view the document.² However, PDF typically requires investment in stand-alone software packages to convert native file formats to PDF; because the PDF specification has been released as a standard it is possible for independent software vendors to create their own PDF output capability; one company that has created its own independent PDF generating capabilities is Corel which has provided this feature within WordPerfect version 9.0.

The ITA also includes several Internet-derived standards for documents, including the following:

- Hypertext Markup Language (HTML),
- Standard Generalized Markup Language (SGML), and
- Extensible Markup Language (XML).

HTML is the primary Web document presentation standard; HTML helped establish the Internet by providing a universal way to present information. However, HTML only addresses the presentation of data.

SGML is a language for coding hierarchical structures and so can be used to mark up hierarchically structured data of the type typically found in books. The standard defines a set of semantics for describing document structures, and an abstract syntax of formally coding document type definitions. Unfortunately, SGML is considered too complex for day-to-day document production and exchange. The third alternative, XML, provides greater functionality for the immediate future.

XML, a sub-set of SGML, describes a class of data objects called XML documents and partially describes the behavior of computer programs which process them. XML is a non-mutually exclusive alternative to HTML. HTML describes document structure and visual presentation, while XML describes data in a human readable format with no indication of how the data is to be displayed.

XML is a meta-language used to define other domain- or industry-specific languages. To construct your own XML language (also called a "vocabulary"), you supply a specific Document Type Definition (DTD), which is essentially a context-free grammar like the Extended BNF

² The PDF standard is specified in "The Portable Document Format Reference Manual" by Adobe Systems, Inc., Addison-Wesley Publishing Co., 1993, ISBN 0-201-62628-4. More recent extensions to the technical specification are published electronically via the Internet at www.adobe.com. An inter-agency group within the federal government has recommended that the National Institute of Standards and Technology (NIST) developed a Federal Information Processing Standard (FIPS) based on the published PDF specification.

(Backus Naur Form) used to describe computer languages. In other words, a DTD provides the rules that define the elements and structure of your new language. Any browser (or application) with an XML parser can interpret the web page by using the rules defined by the DTD.

XML is designed to be transmissible over the Internet in such a way that document browsers do not need to access the document type definition to validate the document before display. Since XML is truly extensible, rather than a fixed set of elements like HTML, use of XML will eventually eliminate the need for browser developers and middleware tools to add special HTML tags (extensions). Microsoft, and all other major software vendors, are making extensive efforts to support XML documents, for display as well as for document creation.

Information Exchange Protocols

To exchange information in a standard way, the ITA relies on the Internet to provide standard protocols for functions such as file (FTP) and multimedia document transfer (HTTP). An important area of network service, however, has resisted full standardization and interoperability: electronic mail. Electronic mail protocols, particularly for the post office and client, are still dominated by vendor-specific implementations. The dominant industry products are Microsoft Exchange, Lotus Notes Mail and cc:Mail, Novell GroupWise, and an array of Internet-sourced products such as Eudora and Netscape's mail client.

The ITA addresses electronic mail not as just an office automation function, but as a broader message handling transport. Increasing numbers of information system applications use electronic mail as a general-purpose message interchange protocol. Electronic mail plays an important role in E-filing. The ITA does not specify how filings are submitted to the FERC but assumes that electronic mail is a viable alternative. The area where electronic mail standards are strongest is in the messaging backbone the network connection between electronic post offices. In this area, SMTP and MIME, for attachments, provide a well-supported set of standards to establish ITA interoperability.

The other related Internet post office and client standards, POP and IMAP, are working their way into currently proprietary products from Microsoft, Lotus, and Novell. Adoption of SMTP and MIME will provide enough product support and interoperability to maintain messaging systems that meet E-filing ITA requirements.

An additional architectural feature that supports e-mail is that of a LISTSERV. A List Server provides the functionality necessary for automated mailing of documents. This function could be used by FERC to enable individuals or industries to subscribe to Commission issuances. This automated workflow process would reduce the quantity of documents that must be mailed to parties in a proceeding.

Directory Services

Directory services are strongly related to many other areas. Security depends upon a well-defined and well-maintained directory of principals (users) and resources (information, processing, communications). Unfortunately, there are several competing standards in the directory services market, and the interoperability problem is not completely solved. The ITA adopts the Lightweight Directory Access Protocol (LDAP) as the standard of choice. It is simple, covers a wide range of applications, and is well supported by commercial products. However, many information security tools, particularly those used to build Public Key Infrastructures (PKI), rely on the X.500 directory protocol. Finally, DCE directory services are included in the ITA list. Similar to the strategy used in distributed systems standards area, the ITA includes all three of the dominant industry standards (LDAP, X.500, DCE), with a preference for LDAP if the requirements of E-filing do not drive the selection to an alternative.

4.5.3 Communications Infrastructure Standards

Communication services and associated standards are a fundamental part of establishing interoperability. In general, most mainstream communications service standards are mature and supported well by industry. The popularity of the Internet has bolstered interoperability between different products and platforms based on TCP/IP and related standards. E-filing will benefit from this situation.

The communication infrastructure must be able to support the same level of service and performance in the Commission's five regional offices as in the main office in Washington, DC. The standards should reflect document filing in both the regional offices and the main office, and the need to transmit text and graphics between the main office and the Regional Offices and between regional offices. For filings submitted to the regional offices, the official receipt date is the date received in the regional office.

Local and Wide Area Networking

TCP/IP is the standard ITA transport service in wide area and local area environments. FERC should fully transition to TCP/IP on the LAN and WAN as new capital investment opportunities arise. The Internet has solidified the position of TCP/IP as a leading standard for end-to-end connectivity in both LANs and WANs. The current version of IP, version 4, is widely supported. The upcoming version, version 6, promises a future growth path but the current thinking is that IP version 6 will not become a dominant standard until well into the twenty-first century.

At the lower levels of the LAN protocol stack, the ITA adopts the Ethernet family of standards. Ethernet is extremely flexible in terms of

wiring requirements and throughput capacities. All new LANs should be configured to support both 10 Mbps and 100 Mbps Ethernet. The high-end 1 Gbps Ethernet is still a very new standard and will be monitored by FERC for future adoption.

The protocols rejected for LANs include Token Ring and ATM (although ATM is recommended for WANs). Token ring has not received the industry support Ethernet has; as a result, Token Ring implementation costs are generally much higher. ATM, as a desktop or LAN standard, is still immature. Although ATM has been touted as a promising single end-to-end protocol, stretching over LANs and WANs to connect two desktops or a desktop to a server, there are still technical and practical obstacles in fulfilling that promise.

The two primary WAN transports are Frame Relay, for low to medium speeds (fractional to full T1: 1.55 Mbps), and ATM for high speeds (155 Mbps to 2.4 Gbps).

Network Management

Total Cost of Ownership (TCO) is receiving a lot of attention in the industry. IT managers realize that operations and maintenance costs of client/server and other distributed architectures follow a different model than traditional centralized information systems. TCO can grow beyond expectation if not explicitly addressed during system conceptualization and design. Enterprise management is a tool for controlling TCO in a distributed environment. Enterprise network management will play an increasing role in the design and operation of the E-filing communications infrastructure as it matures.

Two important enterprise network management standards are included in the ITA: SNMP and MIB II. These protocols are Internet-sourced and specify the monitoring and control protocols for network devices and the structure that describes the particular device being monitored. Enterprise management includes many more functions than those covered by SNMP and MIB. FERC E-filing system implementers should choose an enterprise tool such as IBM Tivoli, HP Openview, or CA Unicenter that includes MIB and SNMP as underlying standard protocols.

The Mail and Directory Management MIBs define a framework for the management of networked applications. This definition is from a service perspective and is independent of the implementation of the application in terms of processes or installed files. Three MIBs have been defined. The first is the Network Services Monitoring (NSM) MIB which defines the generic attributes for management of network applications. The remaining two MIBs are extensions of the first for the management of Message Transfer Agents (MTA) and Directory Systems Agents (DSA).

4.5.4 Processing Infrastructure Standards

Processing infrastructure standards include those for the operating system, presentation, distributed computing, language, and database services.

Operating System Services

Operating system services is an area dominated by proprietary products, not independent standards. The exception to this rule is POSIX. POSIX provides a comprehensive specification of nearly every operating system function. Most vendors have an implementation of the POSIX standard, but many extend it to add unique proprietary features.

The ITA standards for operating systems recognize that proprietary operating systems, such as those from IBM and Microsoft, will continue to dominate the industry and are an acceptable alternative. However, the MS-Windows family of desktop operating systems should be viewed primarily as a workstation/personal computer application environment and graphical user interface that does not provide authentication or access control features suitable for the protection proprietary or privacy-sensitive information.

JavaOS is an open standard, owned and maintained by Sun Microsystems, that specifies a full operational environment for executing portable Java applications. JavaOS is included in the ITA as an emerging standard to be monitored as it matures for possible later adoption. As described earlier, the network computing model and lightweight client design strategies are might play an important role in the future of E-filing at FERC. Java and its support environment are key technologies in implementing these strategies. However, Java still currently lacks sufficient security and performance characteristics to warrant full adoption. Deployment should be limited to situations where the FERC has full control over the Java server and client application and environment.

Presentation Services

Open but proprietary products dominate the user interface. It is projected that Microsoft Windows (95, 98 and NT) will be installed on more than 90 percent of new personal computers purchased. In the browser market, Microsoft Internet Explorer and Netscape Navigator collectively control more than 95 percent of the market. FERC will support these dominant user interfaces.

Distributed Computing

Until recently, there were three battling factions in distributed system standards: (1) the Distributed Computing Environment (DCE) defined and maintained by the Open Group, (2) the Common Object Resource

Broker Architecture (CORBA) from the Object Management Group, and (3) the Distributed Component Object Model (DCOM) from Microsoft. Many factors, particularly the dominance of the Internet, have caused DCE and CORBA to align and in many ways interoperate. DCE does not include any object standards expressed in CORBA; and CORBA can benefit from some of the mature distributed system management functions in DCE. These two standards have become complementary rather than competing, but there continues to be competition between DCOM and CORBA/DCE.

DCOM has its roots in desktop software objects. Its predecessor, Common Object Model/Object Linking and Embedding (COM/OLE), is the fundamental tool used to build Microsoft Windows applications. CORBA has its stronghold in the network. The Internet Inter-ORB Protocol (IIOP) is a powerful and widely accepted mechanism that allows software objects to interoperate over the Internet. Although DCOM and CORBA have attacked the industry from two different starting points, they are rapidly gaining in each others strengths. CORBA has strong backing from a broad set of vendors including Netscape, Oracle, IBM, and Sun. DCOM has strong backing from Microsoft.

The distributed system/distributed object standards battle is far from being resolved. This technology is very important in the design and implementation of new distributed systems. Based on FERC's Microsoft server and application legacy systems, we recommend that FERC adopt DCOM for use in the distributed architecture arena. Because the entire industry is in this situation (faced with two strong competing standards), tools are available to translate between the two standards.

Because distributed systems are relatively new on the technology landscape, there are some emerging standards that show promise but that are too immature to include in current implementation plans. For example, Java Beans is an object implementation extension to Java. This standard will become an important tool in implementing the network computing model. Another example, Web NFS, promises to provide a way to implement a single, coherent file system over a very large distributed environment such as the World Wide Web, but it is still more of a research topic than an implementation tool.

Programming Languages

The ITA focuses on strategy and long-term architecture targets. Accordingly, Visual Basic, Visual FoxPro, C, and its object-oriented variant, C++, are included as the preferred strategic programming languages. Also present as an emerging standard is Java. Java offers great promise in building open, transportable applications because of its platform-independent nature. In addition, it is the principal technology in developing thin client, network-centric applications.

Database Services

Database services is an area of technology that is traditionally driven more by vendor-specific products and features than independent standards. The three leaders in relational database technology (Oracle, Sybase, and Informix) and the leading mainframe DBMS vendors (IBM, CA, and SoftwareAG) have unique and mostly proprietary data storage and management standards associated with their respective products. Two standards included in the ITA provide standardized data access: ODBC and SQL. ODBC provides product-independent database access. SQL defines a standard query language. Both standards are well defined, but most ODBC and SQL products include ample vendor augmentation and extensions that tend to undermine full application portability.

4.5.5 Security Infrastructure Standards

A fundamental E-filing objective is to make information more readily accessible to those who need it. This increases the importance of information security and the need to ensure confidentiality, integrity, and availability. There are very well-defined practices and procedures for handling National Security Information (NSI). The Commission, however, deals with a lot of industry-related proprietary information. The ITA therefore focuses on how components can use security standards and products to gain the assurances needed to confidently share and protect proprietary information.

Information security technology is an active area. Although there are many mature standards, just as many are emerging. The central Government standard for information security is FIPS 140-1. This FIPS refers to many other standards and defines the protocols that are to be applied for a wide variety of security applications within the Federal Government. FIPS 140-1 includes many well-accepted stable standards such as DES for data encryption and DSA for digital signature. However, the FIPS has not been able to keep up with the rapid pace of change in information security technology. Many standards that the FERC may require are not addressed by FIPS 140-1. Many Federal Government agencies are finding that they have to go outside the FIPS to implement their information security policies. The ITA starts off with FIPS 140-1 as its guiding standard. Other mainstream information security standards are added to provide a full range of security services.

The additional security standards originate from two sources: (1) the Internet and (2) a long-time leader in information security, RSA. The Internet has spawned a number of useful security standards including Secure HTTP (S-HTTP), and Secure Sockets Layer (SSL). However, the motivation for these standards has been primarily to support electronic commerce on the Web. By themselves, these protocols are not broad enough to implement even the most basic information system security policy. They must be augmented by other standards in FIPS 140-1 and in

some cases developed by RSA. RSA publishes a list of specifications, each labeled “PKCS-number, that describes methods and protocols for using public key encryption technology to secure information systems.

Added to the list of standards are Secure MIME (S/MIME) and Internet Protocol Security (IPSEC). S/MIME secures electronic mail attachments. IPSEC is used to create Virtual Private Networks (VPNs). VPNs allow the use of public, non-secure telecommunications facilities to build private subnetworks that protect information from unauthorized access.

4.6 E-Filing Standards Profile

Appendix D contains a detailed list of the proposed standards to be used within the FERC E-Filing Technical Architecture: Technical Reference Model and Standards Profile. {summary provided in Appendix D)

The primary categories included are as follows:

CATEGORY	PURPOSE
SYSTEM SERVICES	Details the Operating System Services, Directory and Naming Services, System and Network Management Services, and Application Software Development Support Services
COMMUNICATION SERVICES	Details LAN, WAN, cable plant, connectivity, facsimile, Multimedia and Collaborative Communication Services, and Distributed Computing Services
INFORMATION SERVICES	Details Infrastructure Application Services, Data Management Services, Data Interchange Services, and Transaction Processing Services
HUMAN/COMPUTER INTERACTION SERVICES	Details User Command Interface Services, Character-based User Interface Services, Windowing Services, Graphics Services,
INFORMATION SECURITY SERVICES	Details Identification Services, Authorization Services, Access Control Services, Authentication

	Services, Data Integrity Services, Non-Repudiation Services, Confidentiality Services,
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4.7 Managing the E-Filing TRM and Standards Profile

4.7.1 The TRM Change Process

The Technical Reference Model plays a pivotal role in furnishing information to projects by translating concepts into platforms and services and providing the basis by which project teams can determine whether their requirements can be satisfied using the ITA's standards and products. To fulfill this role, the Technical Reference Model must be evolutionary in nature. Standards and requirements for new products will continue to emerge and evolve as state-of-the-art technology is advanced. Consequently, changes to the ITA Technical Reference Model may be identified at any time by anyone within FERC. Suggested changes need not be associated with a particular project.

Exhibit 4-2 below illustrates the process for incorporating changes into the Technical Reference Model. A change proposal is prepared by the originator describing the nature of the change and the specific changes proposed. These may identify addition, modification, or deletion of particular standards, products, or version numbers. The originator submits the request through the appropriate channels for coordination of the change review.

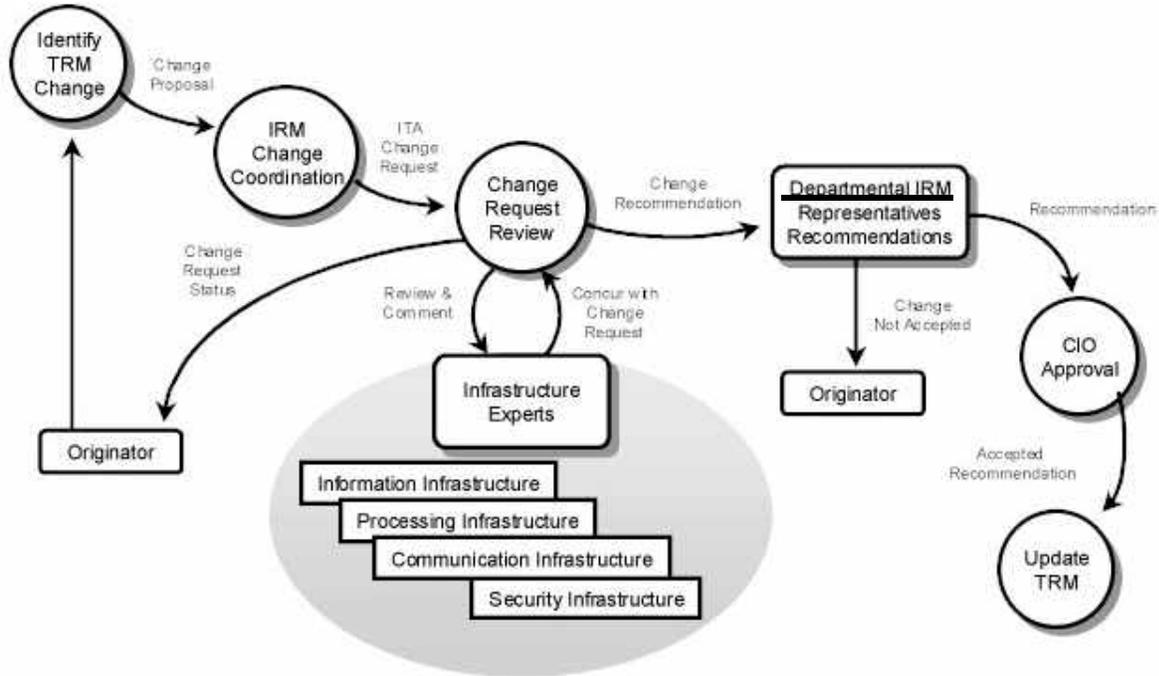


Exhibit 4-2: Change Request Process

4.7.2 Obtaining a TRM Waiver

The standards, platforms, and products included in the model will be adhered to unless a waiver has been obtained because:

- 1) the requirements of the project cannot be met by the existing standards and products, or
- 2) adherence to the existing standards and products would not be cost effective over the life of the project, or
- 3) new standards, platforms, or products have become available that can provide more cost-effective solutions in support of requirements.

The ITA waiver process is much like the change process, the distinction being that the change process provides a mechanism by which the Technical Reference Model may be amended and kept up to date; the waiver process addresses materials needed from projects that deviate from the architecture.

Section 5 – The Future of E-Filing at FERC

To this point, the Electronic Filing Strategic Plan has addressed the FERC organization, its core filing requirements, its current IT infrastructure, and the ITA to support E-Filing. As a capstone, this section discusses the future of E-Filing at FERC. This includes the goals and ensuing benefits of E-filing, technical and business-related implementation considerations, and a strategy for the transition from paper to paperless.

5.1 Goals

According to the Office of the CIO, the vision statement for FERC's E-filing Initiative reads:

“We will provide Commission staff and our customers (regulated entities and the general public) with efficient, cost-effective access to the information they need—when they need it—and in a format that is useful to them.”

Similarly, FERC's E-filing Initiative goal statement is:

“To provide more information to Commission staff, regulated entities, and the public in a more flexible, practical, and efficient way and to improve our regulatory processes by reducing the cost and volume of paper filed by applicants and intervenors with FERC and each other.”

These goals have several drivers; the first and foremost is to increase the efficiency of the regulatory process thus reducing cost and increasing taxpayer benefit. Other drivers include the reduction of burden to regulated entities and compliance with the government's paperwork reduction initiatives. These drivers could be considered high-level benefits and, in fact, are embedded in the specific benefits of E-Filing.

5.2 Benefits

Stable and timely regulatory treatment of regulated companies and their customers is a strategic goal of the FERC's E-filing initiative. This can be achieved by creating process improvements to both the flow of information and the processing of that information within FERC. An electronic filing system can be used to create an automated workflow that creates a consistent approach to work as well as reducing the processing cycle. Timely access to filed documents can be provided, virtually in

real-time, by posting the documents to the FERC web site following a quality control process.

Easier access to more complete information can also be enhanced by e-filing. In a properly designed system, external entities can relate an e-filing to subsequent issuances by the Commission that are the result of that filing.

Data integrity can also be enhanced with an E-filing process. In addition to having direct access to the “as-filed” document, there is also the ability to incorporate the text-based information directly into FERC databases using XML, thereby enhancing on-line search capabilities.

Cost-based benefits can also be considered, both to industry as well as to FERC. It is generally accepted that industry uses industry-standard computers and computer-based software programs to generate the documents required by FERC. Consequently, allowing the industry to use computer-generated output will decrease their operating costs. e.g.: printing, copying, mailing, and courier service associated with filing paper documents. This benefits regulated entities by ensuring the regulatory process does not impose an unnecessary burden or impede their efforts to be profitable. The cost-reduction to FERC can be in the form of minimizing, or eliminating, complex workflow processes; e.g., the scanning of hard copy documents.

An adaptable filing process can provide additional benefits. The Electronic Filing pilot project has already demonstrated the benefits of an adaptable (i.e., modifiable) filing process. This was done by implementing a client-server architecture; this virtually eliminates the problems associated with configuration management of different versions of stand-alone applications.

All of the benefits discussed here can be rolled up into a few high-level strategic benefits—reduced costs and more efficient operations. Automated business processes, accurate and readily available information, and flexible IT solutions all help to achieve these benefits.

5.3 Implementation Considerations

5.3.1 Business/Process Considerations

Continued implementation of electronic filing must take into consideration the three primary entities that are associated with FERC; they consist of:

1. The regulated industries

2. FERC
3. Controlling agencies and document recipients, including federal regulations, OMB and NARA.

Regulated Industries

FERC has demonstrated a willingness to work with industry to create an improving E-filing business process, and industry is likewise to be commended for participating in the pilot project. This working relationship is critical to ensure that future process improvements are based on mutual goals having a direct effect on cost reduction for both parties. FERC will have to complete additional cost/benefit analyses prior to implementing additional E-filing efforts.

The following quote, taken from a Gas Industry article, demonstrates the industry's perspective on FERC's standardization of business processes:

“As a voluntary organization composed of representatives of many segments of the industry, GISB developed and adopted standardized business practices aimed at simplifying the process of transacting business across the interstate natural gas pipeline grid. The Commission reviews and adopts those standards and subsequently reviews individual filings by natural gas pipeline companies to comply with those standards. By standardizing business practices, transacting business with multiple pipelines and suppliers should be easier for customers.”

But e-filing must consider the wide range in size, capabilities, and resources of the regulated and non-regulated entities that interact with the Commission, including individual landowners.

FERC

FERC recently completed a Business Process Re-engineering initiative called FERC FIRST!, and is implementing most of the organizational and procedural recommendations of the re-engineering team. One BPR issue that is being addressed is the workflow process. This effort must ensure that any gains or improvements made by electronic filing are not hindered by non-electronic processing, i.e., all manual processes immediately following the electronic filing process. FERC must ensure that manual processes related to the receipt of filings are minimized or replaced by automated methods.

Controlling Agencies and Document Recipients

OMB is largely responsible for the technological revolution that is taking place in Government. Clinger-Cohen (establishment of the CIO) and conditional funding based on proper IT strategic planning have forced IT to the top of agency agendas. OMB's role in implementing E-Filing is significant. It will ultimately provide funding for the initiative based on the FERC's E-Filing Strategic Plan. The Commission must demonstrate a comprehensive understanding of E-Filing and how it affects FERC, their business processes, their IT investments, and their industry partners.

OBM also provides guidance to agencies that are required to comply with the Government Paperwork Elimination Act. GPEA mandates that agencies be able to accept electronically filed documents by 2003 and that any agency accepting more than 50,000 documents on an annual basis must give filers two options for providing digital signatures.

On Friday, June 30, 2000, President Clinton signed the Electronic Signatures in Global and National Commerce act (E-Sign) that passed through Congress two weeks earlier. The new digital signature law will render digital signatures legally equivalent to those signed on paper. The bill requires that online users give their affirmative consent to use electronic versions of paper forms and allows them to opt for offline equivalents. The bill also requires that agencies disclose to users the hardware and software required for performing the electronic signing and giving the user the same legal protections online as they would have offline. However, the bill does not specify what kind of technology can be used to implement digital signatures.

FERC and its industry partners have agreed that signatures are a necessary component of documents filed with the Commission. By making digital signatures the legal equivalent to paper signatures, E-Sign gives the FERC the backing it needs to complete paperless filing process.

Because E-Sign does not mandate technology, the FERC must be sure that the technology used for implementing digital signatures and authentication is supported by Industry. For example, if PKI (currently recommended by OMB) is used, FERC must establish a trust relationship with each of its industry partners. This could be done through a trusted third party (within or external to the Federal government). PKI also requires detailed policies for establishing and maintaining trust. For example, policies must be established for linking a user to his/her private key. Passwords, smartcards, and biometrics are viable alternatives for this activity. Finally, it is important to emphasize the E-Sign does not mandate that users fill out forms electronically. On the contrary,

it mandates that an offline equivalent be available. E-Sign supports FERC E-Filing initiative by giving digital signatures legal status, but it does legally require electronic filing.

As discussed in the Electronic Document and Records Management Requirements section (Section 2.5), FERC must comply with the National Archives and Records Administration guidelines for developing and monitoring record keeping systems as well as properly designating electronic documents for disposition. The E-Filing solution must include guidelines and processes for use, storage, and disposition of any information it collects electronically.

5.3.2 Technical Considerations

There are numerous technical issues that must be addressed both from the perspective of implementing a “first cut” at E-filing as well as continued modifications to the IT architecture. Primary considerations include the concepts of flexibility, enhancement, security, cost/benefit, and standards.

Web-Enabling Standards and Technologies

An IT architecture based on internet-enabling technology provides the opportunity to pursue continuing enhancements to the electronic business process. However, this enabling technology does arrive with a growing number of expectations on the part of the end-users. For example, client/server based applications are giving way to web-enabled applications; the end user is expecting a web browser interface for the majority of internet-based interactions. With this expectation comes the presumption that any internet-capable web browser will suffice. It can be anticipated that one of the final outcomes of the Microsoft/Justice Department dispute will be a “Microsoft neutral” requirement on the part of Government agencies. This could have a direct effect on the software development efforts proposed by FERC.

FERC’s primary consideration therefore becomes one of flexibility: pursue web-enabling technologies without placing unnecessary constraints upon the end users. This is not as limiting as at first it might appear. Although Microsoft has created numerous “Microsoft-only” solutions they have also adopted, or are in the process of adopting, several industry standards and/or recommendations. The following are a few examples:

- **ECMAScript:** this is the script language originally developed by Netscape (JavaScript) but now supported by Microsoft. ECMAScript has been

accepted as a standard by the European Computer Manufacturers Association (ECMA) (ECMAScript 262). See: <http://webreview.com/pub/98/09/11/feature/sidebar1.html>

- **Document Object Model (DOM):** The Document Object Model is a platform- and language-neutral interface that will allow programs and scripts to dynamically access and update the content, structure and style of documents. DOM allows the document to be processed and have the results of that processing incorporated back into the presented page. Numerous companies are participating in the DOM Working group including both Microsoft and Netscape. See: <http://www.oasis-open.org/cover/dom.html>
- **Simple Object Access Protocol (SOAP):** The Simple Object Access Protocol is an XML (Extensible Markup Language)-based RPC (remote procedure call) standard originally developed by Microsoft Corp., Develop Mentor Inc. and UserLand Software Inc. (later joined by IBM and Lotus Development Corp.) that can greatly simplify cross-language and cross-business development.

One final thought concerning Microsoft needs to be mentioned: despite all comments to the contrary, Microsoft is intent on supporting Microsoft at the expense of supporting standards. A recent technical article will illustrate the point¹:

“eWeek Labs recommends that companies make deployment of IE 5.5 ...a low priority...Microsoft has used DHTML (Dynamic Hypertext Markup Language) to add features...unfortunately, these enhancements serve to worsen Internet Explorer’s support for Document Object Model (DOM), which, unlike Microsoft’s proprietary DHTML is an accepted standard. Given that (*Microsoft’s newest*) initiative is centered on XML, Microsoft seems to be making a wrong turn by falling behind on support for the XML-based DOM.”

In addition to the issue of flexibility, the previous examples also raise an equally important technical consideration, that being the requirement to support standards. The World Wide Web Consortium (W3C) has made significant strides to define web-based standards that can be adopted by the industry. The W3C

¹ eWeek (magazine) July 17, 2000; page 14.

merely makes recommendations, it cannot enforce them. While standards provide a certain degree of flexibility for the end user they also place constraints upon developers. Of special significance is the fact that SOAP, referred to above, is not an industry standard but this is not inhibiting the industry (Microsoft among others) from pursuing enhancements to the internet-enabling technology. This “hot pursuit” does not come without risks; one risk being the first to market with a product that doesn’t meet the end users needs or expectations. FERC will be required to establish clear guidelines, based on risk analysis, that defines the issues surrounding Standards versus nascent web-enabling technologies.

Digital Signatures and Security

Security has taken a front seat as web-based architectures compete with traditional client-server architectures for the dominant position in distributed computing. Web-based solutions open up an entire new arena of security concerns because information is no longer transferred over private LAN/WAN’s but over the public domain. Add on FERC’s legal requirements for signatures and authentication and you have a difficult security requirement.

PKI has been around for many years but it’s full potential has yet to be realized. Just recently, with the proliferation of web-based IT solutions, has PKI begun to materialize as a practical, although still maturing, security solution. PKI provides encrypted data transfer, digital signatures (with non-repudiation), and authentication using hard-tokens and biometrics.

There are several technical issues to consider when designing and building a PKI. Aside from the policy issues discussed earlier, all partners in a PKI have to support the technical components of the infrastructure. If trust is required in both directions, FERC and industry will have to set up a trusted third party Certificate Authority (e.g., Verisign) to validate public keys. If trust is only required in one direction, (i.e., industry groups send encrypted and digitally signed electronic documents to FERC but not vice versa) then FERC can own the Certificate Authority. In this case, FERC would also have to set up directory services to store public keys and related information. Other components include smart card and biometrics readers, which are client-side software and hardware components. A successful PKI must be a collaborative effort between all parties involved.

XML and Data Content Considerations

Extensible Markup Language (XML), a sub-set of SGML, describes a class of data objects called XML documents and partially describes the behavior of computer programs that

process them. XML is a concomitant alternative to HTML, it does not supersede HTML. HTML describes document structure and visual presentation, while XML describes data in a human readable format with no indication of how the data is to be displayed.

XML can be used to provide a vendor-neutral, cross- platform method of transporting, and validating mission critical data. The actual data presentation is handled as a separate process. This will allow a web server to provide data to separate client (e.g. web browser) that is responsible for their own presentation style. Business rules can be created that deal directly with the document's content rather than its specific layout. XML can be used to provide flexibility at the industry's end while maintaining formal control, via business rules, implemented in servers.

The gas industry has already demonstrated an interest in implementing XML as illustrated by the following product announcement:

“The initial release of PetroXML provides a first-ever standardized eXtensible Markup Language (XML) tag set for vendor invoicing for oil and gas field operations. A development kit to integrate XML tagged transactions to users' accounting systems and databases will also be available. The revolutionary XML tag sets create standardized statements for Internet transactions that were previously unavailable from any vendor. Operating companies and vendors will be able to transport detailed invoicing between each other, despite having incompatible accounting systems.”²

Additional efforts are under way to integrate XML and forms processing. The standard, called XForms, is part of a larger effort to replace traditional HTML (Hypertext Markup Language) with XHTML (Extensible Hypertext Markup Language), an XML version. XForms is implemented using Extensible Forms Description Language (XFDL). XFDL is the first submission acknowledged by the W3C for legally binding XML forms. The Securities Exchange Commission, the U.S. Patent and Trademark Office, and other public sector organizations have deployed e-commerce solutions using XFDL³

² <http://www.oasis-open.org/cover/petroXML.html>

³ See: <http://www.uwi.com/news/000705.htm>

Document Retention and Refresh

Encrypted documents created in old formats may not be easily transferred to more modern formats and may not retain assurance of their authenticity. This will eventually include documents created today that may be opened 10 years hence by applications expecting formats that will be in use at that time. The issue centers on how we maintain not only the document files themselves, but also the native applications used to create the documents. OMB does not directly address that issue in its guidance, but suggests that the National Records and Archives Administration should take the lead in working with agencies on questions on and methods for maintaining, preserving and disposing of electronic records.

5.3.3 Industry/Government “Best Practices”

The following paragraphs describe what IT related tools and architecture other industries and government agencies are considering. These examples are not exhaustive

Federal Emergency Management Agency: For future capabilities, FEMA will consider the following tools.

Office Automation Tools:

- Authoring of XML
- Authoring, use, and enterprise-wide integration of electronic forms on the desktop.

“Improved Data Integrity over Life Cycle: The proposed IT architecture will be designed to increase levels of assured data integrity in order to stay in sync with the CIP program, electronic records, documents and data in FEMA IT systems and data bases. This involves setting up adequate policies and procedures to support **digital signatures**, date-time stamping, **long-term archival access**, and hash mechanisms.” *(emphasis added)*

Department of Energy: “Computer security is a major concern at the local workstation level and in a networked environment and standards for developing should be considered. DOE has considered the following options and standards for the proposed security services:

- Encryption techniques
- Integrity, auditing, and electronic signatures

- Operating system security, network security, data interchange security, data management security
- Open system security”

Department of Commerce: “A major goal of implementing EC in the Federal acquisition process is to create a communication and computing infrastructure composed of standard support services, with facilities based on standards and the principles of open systems. The infrastructure must provide a means of interchanging standard transactions at a low cost with minimum impact on existing automated systems. There is a clear need to use open systems based on nonproprietary standards to support extensibility, scalability, portability, and maintainability requirements. Three primary policy variables must be monitored and nurtured: operating system environment preferences, communication protocol preferences, and data base preferences. We recommend an open systems environment including the portable operating system specification (POSIX), the Government Open Systems Interconnection Profile (GOSIP), the structured query language (SQL), and other government-approved protocol suites. “

U.S. Patent and Trademark Office: “The implementation of electronic filing and electronic examination is critical to the efficiency, effectiveness, and operational cost reductions associated with processing patent applications. The Patent Business plans to implement electronic filing and electronic examination in stages. The replacement PALM system, PACR, and PPP will provide the foundation for a comprehensive electronic examination capability throughout the prosecution of a patent application. Upon receipt of electronic input from PACR, the Electronic Mailroom, and automated PCT operations (POWER), the Tools for Electronic Application Management (TEAM) system will create the electronic file wrapper. As presently envisioned, the TEAM system will be capable of processing an application file from the point where it enters the Examining Group to the publication of the application file in electronic format... The Patent Business is conducting a pilot of electronic filing of patent applications in FY 2000 and will begin accepting electronic applications in FY 2001. Significant use of electronic filing by applicants will greatly improve the quality and lower the cost of the data capture process. The Patent Business plans to promote the use of electronic filing to facilitate Pre-Grant Publication.”⁴

⁴ http://www.uspto.gov/web/offices/cio/sitp/sitp_eo.html#sitp_eo_f4

PeopleSoft: PeopleSoft Inc. has just released a new version of their applications which include "...59 new E-business applications, a new Web architecture, and a browser-based user interface.⁵

5.4 Transition Strategy

Fully implementing an electronic filing process for FERC will require a smooth and effective transition. This will require a detailed Transition Strategy that addresses the concerns of industry and FERC and captures the required modifications to business processes, document management, and the IT infrastructure. The following paragraphs elaborate the essential elements that must be included within the transition strategy.

Incremental change. It is essential that FERC adopt an incremental change paradigm. The alternative to incremental change is what is referred to within the industry as the "systems leap" paradigm; the leap occurs when organizations standardize on a system for several years, and then "leap" forward to new systems every 3-5 years. The preferred approach, "incremental change" occurs when organizations continuously adopt incremental upgrades in software and hardware, "slipstreaming" technology change into daily work patterns. An incremental change strategy has several advantages:

1. Training costs are kept to a minimum because support staff can be trained in short "mini-sessions" which disrupt work in progress less than traditional all day classes;
2. Staffing and communications problems are minimized by utilizing current technology; and
3. Budgetary considerations are minimized because full system replacements are obviated.

Rolling replacement. Closely tied to incremental change is the "rolling replacement" concept. Budgetary constraints inhibit the ability to perform a complete enterprise-wide system replacement every few years. Instead, organizations are increasingly adopting "rolling replacement" strategies in which, for example, a third of the organization's notebook computers are replaced each year. Carefully planned, a rolling replacement strategy can normalize technology spending over a period of years, so that technology spending mimics a business expense

⁵ informationweek.com (magazine) July 17, 2000; page 32.

model rather than a capital replacement model. As already noted, FERC is to be commended for adopting this model with respect to desktop computers. The present transition from Token Ring to Ethernet also satisfies this model.

Risk Analysis. In order to comply with Federal Regulations regarding IT related security, it will be necessary to establish a Risk Analysis program.

see: <http://www.cio.gov/docs/gpea2.htm>

File Formats. The pilot project for electronic filing has already established a policy for accepting electronic documents. The existing policy established a flexible process that seems to satisfy both FERC and industry. Recent events with Microsoft and the Justice Department, along with the financial difficulties faced by Corel (i.e. WordPerfect), would dictate that prudence is of the utmost concern with respect to file formats; that is to say, any effort to implement industry standards could obviate any legal concerns.

Operating Systems. There is less immediate concern about the differences among operating systems. Both FERC and industry are standardized on Microsoft operating systems. Again, with respect to recent events, it would be advisable to develop a transition plan that does not require industry to employ the “official” OS. As an example, the Visual Fox Pro (VFP) form applications all require the Microsoft OS. Additional forms are being created that support the same methodology. It is not necessary to perform a “system leap” (see reference above) to accommodate this suggestion; as an example, it is possible to deploy a web-based solution, used by industry, that would deploy XML to populate the VFP database on the backend. All applications, and IT infrastructure procurements should be evaluated as to their transitional/upgrade capabilities.

Document Capture and Content. There are several issues related to the document capture and content. One of the primary concerns related to the filing process is the “as-filed” process. As noted previously, this is complicated due to differences in applications used by industry. Documents are presently captured via three primary methods: 1) the actual hard copy is retained, 2) the electronic version is saved in both original format and converted format (e.g. PDF), and 3) the image is scanned and saved as a non-editable image document.

All industries in general have recognized the benefit of referencing documents by paragraph number rather than the page number. The move toward electronic filing should accelerate a move toward this approach.

Document scanning needs to consider the benefits associated with Optical Character Recognition. The re-distribution of captured documents, via the web pages or other electronic means, can benefit from the improved readability of OCR'ed documents.

Once the content of the submitted documents are captured it becomes more important to focus on data content rather than data format. Web page layout and search engine capabilities are not dependent upon the original document layout but only upon the document content. This focus can greatly enhance the business process by enabling the automation of data content.

Client/Server and Web-based Applications: The industry is clearly moving away from a client/server based architecture to a web-enabled architecture. This can consist of simple HTML web pages, HTML Forms, PDF Forms, Java applets, etc. The FERC development team will have to balance end user expectations with clearly defined goals, benefits, risk analysis, etc.

Pilot Projects. FERC must continue the transitional efforts established by the first E-filing pilot project. The next phases of development have already been established by the FERC development team but the development focus also must take into consideration the newly available technology (e.g. XML) as well as the industry approved standards. The following table, Exhibit 5-1, is offered as a point of discussion for the original planned phases with consideration given to the possible standards and technology that could be implemented during each phase. The speed of internet development requires that each phase be reevaluated prior to pilot project initiation.

	PHASE 1	PHASE 2	PHASE 3	PHASE 4	PHASE 5
	Motions to Intervene	Gas, Electric & Oil Rate Filings (including Tariffs)	Gas Pipeline Certificate Applications (except maps)	Maps (for Gas P/L and Hydro Applications)	Protected Data
	Comments	Gas, Electric & Oil Forms and Reports	Hydro License/Relicensing Applications (except maps)	GIS System	Privileged Data
	Protests	Other Hydro Reports		Autocad drawings	Briefs
	Answers				Testimony
	Other Motions				Exhibits
	Form 1				
	Hydro Dam Safety Inspection Reports				
STANDARDS to consider for Implementation	VFP forms (in process)	XML, including XML-based forms	PDF based Forms, SOAP	Vector Graphics	
		Digital Signatures	web-browser independence; W3C approved		
		Optical Character Recognition	ECMAScript		

Exhibit 5-1: Standards and Phased Implementation

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