# Insights to Building a Successful E-Filing Case Management Service: U.S. Federal Court Experience

**J. Michael Greenwood[1] and Gary Bockweg[2]**

## Abstract

The U.S. Federal Courts Case Management/Electronic Case Files (CM/ECF) service is a very successful court automation system deployed throughout the country that integrated case management, electronic court case records and documents, and the electronic transmission and service of court records via the Internet. The authors briefly explain the history of automation development and indicators of success in these courts. The primary focus of the article is (a) on what capabilities and functions should be integrated into any modern court electronic filing and case management service; and (b) on insights as to key technical components, fundamental project guidelines, technical objectives, and non-technical principles and implementation techniques that were critical to achieving success. The ultimate CM/ECF goals that have been achieved are (1) that the entire U.S. federal court community (court, lawyers, government, public) are comfortable in totally relying on this service, and (2) that CM/ECF is the official record eliminating the traditional paper record.

## I.  Background & History

Court automation is not a new phenomenon in many national judiciaries, but the scope and level of development varies tremendously even among more advanced industrialized countries.[3] To date, only a few countries have attempted comprehensive integration and automation of court case records, case management, document management, and electronic transmission and receipt of records.[4] Many courts claim some progress[5], but few have succeeded.[6] This report focuses on the US Federal Courts Case Management/ Electronic Case Files (CM/ECF) system, a comprehensive, fully-integrated, judicial automation service with an established record of long-term success.[7]

The U.S. Federal Courts are composed of the U.S. Supreme Court, twelve Courts of Appeals, ninety-four District Courts (general trial courts responsible for both civil and criminal litigation), ninety  Bankruptcy Courts (specialized trial courts responsible for both individual and corporate cases), and a few specialized courts such as the  US Court of International Trade. There are 758 court facilities, 2,300 judges and magistrates, and 34,000 clerical and administrative staff located throughout the fifty states and overseas territories.[8] For several decades before CM/ECF, US federal courts had deployed various word processing, electronic mail, and electronic case management systems. [9]

---

[1] He was Project Manager during the initial prototyping and implementation phases of CM/ECF at the AOUSC, and co-creator of the PACER service. He has worked developing and implementing various technologies into the U.S. court process for over thirty-five at the National Center for State Courts, Federal Judicial Center and AOUSC. In recent years, he has consulted for the Russian Federation, Ukraine, and Abu Dhabi courts.

[2] As Chief, Technology Division, Office of Court Administration, AOUSC, he has served as CM/ECF project director since the project's inception in 1995. He worked as an IT specialist with financial institutions and with the Advanced Research Projects Agency (ARPA) before becoming an attorney and joining the Federal Judicial Center in 1978. In over thirty years at the FJC and the AOUSC he has helped to develop five generations of case management systems and has engaged in case management demonstrations and discussions with delegations from many countries around the world.

[3] , "Use of Information & Communications Technologies (ICT) in European Judicial Systems" by Marco Velicogna (http://www.coe.int/t/dghl/cooperation/cepej/series/Etudes7TIC_en.pdf) provides a comprehensive review of the diverse automation efforts in Europe.

[4] Austria, Australia, Canada, Israel, Singapore, and South Korea are some examples.

[5]  Various US state courts publicize electronic filing but with restricted or limited capabilities and minimal integration into an automated case management system. See http://www.ncsc.org/topics/technology/electronic-filing/state-links.aspx.

[6] Op Cit 1;  2009 NCSC E-Filing Survey (Activities in US state courts)
 http://www.ncsc.org/Services-and-Experts/Areas-of-expertise/Technology/2009-E-filing-Survey.aspx

[7]  The authors thank several colleagues who have reviewed this paper, and who have extensively worked on the formulation and development of this service throughout the years Andy Sirotta, John Brinkema and Rick Fennell, and to Noel Augustyn who has been a constant and avid supporter as executive sponsor.

[8] For a comprehensive explanation of the US federal courts structure, legal jurisdiction, and authority see www.uscourts.gov.

[9] The first major automation initiative (1975-1981) was Courtran, a criminal case management system using central computers among thirty district courts. Word processing and rudimentary electronic document exchange services were introduced in judge's chambers (1978-2004). Various mini-computers were installed in district courts (1979-1985) for several specialized functions such as criminal speedy trial reporting, party-case indexes, and case dockets. An Integrated Case Management System (ICMS) and several comparable bankruptcy services (NIBS, BUMS) were implemented (1985-1998) to handle case management and docketing functions, but excluded

The U.S. Federal Courts have various centralized administrative and policy-making groups that promulgate legal and administrative policies, delegate authority to various organizations at the national, regional or local court level, and distribute funding and resources, including personnel and computer resources to the courts. The automation resources are generally controlled by a centralized authority, the Administrative Office of the US Courts (AOUSC), but the actual automation operations are substantially controlled and operated by each court. While general automation policies, hardware procurement, and programming are centralized, regional and local court units are primarily responsible for the deployment, training, and precise use of the service in their jurisdictions. Therefore, the case management system was built to be flexible to meet the diverse needs of the various jurisdictions, types of litigation (civil, criminal), and levels of court (courts of first instance, appellate).

## II.  Development & Growth of CM/ECF – Measures of Success

An early prototype of CM/ECF was created in the fall, 1995 by a small AOUSC automation group to explore the creation of a fully integrated case management and electronic filing (and e-files) service for a large asbestos litigation in a US district court.[10] This service became operational in January, 1996, and was then revised and implemented in the fall of 1996 for one of the largest US bankruptcy courts that is responsible for many large corporate bankruptcy cases.[11]   In 1997, the AOUSC published "Electronic Case Files within the Federal Courts: A Preliminary Examination of Goals and Issues on the Road Ahead".[12]  By 2005, 80% of the courts had fully implemented CM/ECF, and now all courts use CM/ECF. [13] Yet, little has been published describing the system and explaining the primary reasons for this success.

Success can be measured in many ways: the degree of adoption by courts, legal community, and the public; the volume and extent of usage both transmitting documents to and from the courts; the reliability, validity and dependability of the service; the efficiency and effectiveness of the service and productivity of staff; and improvements in the overall quality of justice.

All federal judicial officers (general trial and appellate judges, magistrates, and bankruptcy judges), and court legal and administrative staffs (law clerks, deputy clerks) have adopted CM/ECF as the official record and case management system. Over 625,000 lawyers have electronically submitted documents into CM/ECF.  Each year there are more than 2,100,000 new cases opened, over 60,000,000 new docket entries and electronic documents submitted, and 525,000,000 e-notices transmitted from the courts to parties. CM/ECF systems maintain sizeable amounts of court information, with 41,000,000 cases, over 500,000,000 documents, and 850,000,000 docket entries that include active and closed cases.[14] Demand for CM/ECF services is substantial, with over 325,000 individuals and organizations annually making one-half billion public access (PACER) inquiries, and downloading several billion pages of court information and documents. [15]

CM/ECF servers/systems are almost always on-line, the entire day and night 365 days of the year. Newly submitted documents, docket entries, and updates are available to all users within seconds, and automatic court e-notifications are transmitted within a few seconds or minutes.

CM/ECF services have proven resilient in several major natural and man-made calamities, and in dramatic changes in filings and government policies. The 9/11/01 terrorist attack on the World Trade Center, the Katrina hurricane that decimated New Orleans and other Gulf localities in 2005, and floods in several Midwestern states caused only minor disruptions to CM/ECF services.[16] US Congress enacted dramatic changes to the US bankruptcy law in 2005 that caused

---

electronic files and filing. Public access services (Public Access to Court Electronic Records (PACER), and Voice Case Information Services) using rudimentary modems, computers, and standard telephones were also introduced (1987-93).

[10]  The US District Court for the Northern District of Ohio, headquartered in Cleveland, received tens of thousands of new asbestos cases each year, with each case involving approximately 100 parties.

[11] The US Bankruptcy Court for the Southern District of New York regularly adjudicates large corporate bankruptcy cases (Exxon, Worldcom, Delta Airlines, Lehman Brothers, General Motors) each containing 25,000 to 35,000 documents, and involving hundreds and sometimes tens of thousands of participants.

[12] See http://ruessmann.jura.uni-sb.de/grotius/Material/ecfmar97.pdf.

[13] The U.S. Supreme Court has its own administrative and technology services and does not use CM/ECF.

[14] This includes older cases converted from legacy case management services.

[15]  There are over 1,300,000 PACER registrants.

[16] The federal courthouses in New Orleans, Eastern District of Louisiana, other localities in the Gulf region, and the U.S. Bankruptcy Court for the Southern District of New York, located within a few city blocks of the World Trade Center, were inoperable for several weeks; however, CM/ECF services continued operations while court personnel were relocated to other government offices in nearby suburbs or cities. No official records were lost or misplaced, and no significant disruption of court services occurred.

huge increases in new cases filed for many months, but caused no increase in court staff resources nor any delays in case processing.[17]

Various organizations and judicial authorities have described what is desirable or necessary for a judiciary to provide electronic case management and electronic filing services.[18] CM/ECF has achieved or exceeded all standards or principles published by various authorities. These principles include issues such as: equal and timely access (written, audio, and video) to court records; continuity, and sustainability of service; quality, security and verification of information, transparency of legal process; efficient exchange of information between government entities, and on-line publication of opinions.

## III.    **CM/ECF Major Components & Functions**

The traditional case docket written or typed by court personnel serves as an annotated index listing basic case information,  various documents and case events in chronological order, usually attached to a folder containing the case documents retained somewhere in a courthouse.  CM/ECF has fully integrated the opening of cases, the submission of all documents and the creation of docket entries into a comprehensive automated case and document management system. This has also allowed for the electronic filing and dissemination of any case and court information via the Internet, regardless of where and when recipients need to enter or access this information on a case-by-case or court-wide basis. This approach has greatly reduced duplicate data entry, substantially reduced errors, and eliminated misplaced or lost files or documents. It has also allowed for more timely submission and access to records, permitted greater transparency of all activities, and considerably altered the roles and responsibilities of both court personnel and the legal community.

This section describes various capabilities contained in CM/ECF that most judiciaries should require in any integrated judicial electronic e-filing and automated case management system. [19]

*Case Docket & Docket Entries: Case Opening & Case Dockets*
A case can be opened on-line via the Internet by court personnel, lawyers or litigants. All docket entries and documents are electronically submitted, reviewed and disseminated via the Internet.[20] CM/ECF has created a stylized set of screens controlling and validating the entry of case information into the computer system to insure a comprehensive record and permit standard well-structured case dockets and reports. Various case opening modules are offered depending on the type of litigation and the person opening the case (e.g.; private litigator, court personnel, government representative); and several automated functions (case numbering, judicial case assignment, calendaring including due dates) are created. Most courts have hundreds of types of docket entries and variations.[21]   CM/ECF developed a mini-programming language,[22] using a stylized and flexible set of programming functions that would allow administrative (non-programmers) court staff to: create and control the prompts, type and sequence of information needed to be collected from the submitter; extract from the court's database; display, review, and edit the docket entry; submit, validate and link documents; and

---

[17] The new bankruptcy regulations were effective as of October 2005. During the summer and early fall, new bankruptcy filing and workloads increased by 30 to 50% in most jurisdictions, and a few with a tenfold increase. All bankruptcy courts were fully operational on CM/ECF and the automatic processing and built-in CM/ECF efficiencies eliminated the need for temporary staff and still handled all court activities on time.

[18] For suggested Court Management Automation Standards, see http://www.ncsc.org/Services-and-Experts/Technology-tools/Court-specific-standards.aspx; for Standards for Electronic Filing Processes (Technical and Business Applications), National Center for States Courts, 2003 see
http://www.ncsconline.org/d_tech/standards/Documents/pdfdocs/Recommended_%20Process_%20standards_02_26_03.pdf; see NCSC Resource Guide to Electronic Filing, http://www.ncsc.org/topics/technology/electronic-filing/resource-guide.aspx.

[19] Courts will require additional desirable features over time related to legal, political or cultural requirements. For example, CM/ECF also contains (a) automatic random judicial case assignments, (b) case records management that tracks the paper files of old archived case records, (c) judicial conflict checking that determines whether a judge has a conflict of interest related to investments or interpersonal relationships with a party or counsel involved in a case, and (d) full text searching all cases and documents. These and other future enhancements will be discussed in a separate article (NextGen).

[20] Some trial courts require or strongly urge counsel to open their case(s) on-line from their law offices; other trial courts still require counsel to submit their initial pleading (complaint) at the courthouse, and allow court personnel to open the case on-line. All courts strongly prefer or mandate all additional documents and docket entries be entered on-line via the Internet by the person signing the document. In pro se cases the litigant are restricted on what they can accomplish.

[21] Most docket entries fall into three main categories: (1) case opening includes initial complaints and pleadings, (2) litigators filings including motions, responses, answers, replies, notices, service of process, and (3) court events and documents including orders, notices, judgments, pre-trial and trial proceedings, minute entries, appeals, judicial (re)assignments. The typical federal court has 400 – 500 types of docket entries.

[22] Data Processing Functions (DPF) are written in PERL or JAVA software language -- not to be confused with PDF documents.

---

insure compatibility and integration with other case management functions for each docket entry.[23] This has allowed each court unit to easily change and update the template for docket entries as both national and local rules, regulations, and procedures have been introduced or modified over the past decade, without any significant disruptions or retraining.

### E-Documents
All documents stored in CM/ECF must comport with Portable Document Format (PDF) standards. While any legal document filed with the judiciary may be composed on whatever device or format desired, these documents must be filed as a PDF document that will permit any recipient to view and/or reproduce them.

CM/ECF normally requires the electronic submission of documents as part of the docketing process. This requires the filer to identify the proper document category, to link the document(s) to appropriate case(s) and to other documents in the case (e.g., a response to a motion), and to have properly created a PDF version of the document.[24] The official document is the PDF electronic document, not any paper version. Each document accepted is electronically time stamped, and, if necessary, a document validation program is available to verify that the document in CM/ECF matches the original submission. CM/ECF documents that have limited access or sealed status have additional restrictions.

### Digital Signatures
When the operational prototype was being built in 1995, it was not clear what international standard for digital signatures might be adopted.   It was decided that CM/ECF would temporarily use a traditional login and password for user identification. The successful password authentication of the user would be treated as a "signature" for any documents filed by the user. In addition, the system would generate a "hash table" security stamp for each PDF document filed to detect any subsequent error or tampering that could alter a filed document.  That "temporary" approach has worked so well that it remains in use today.  With hundreds of thousands of users, and millions of documents filed each month, there have been no instances of filers denying that they did, in fact, make a filing that was attributed to them, and no instances of illegal document tampering.  Nevertheless, plans still include incorporating standard digital signature technology into CM/ECF.

### Document and Case Linkages
Each document can be linked to one or more cases; each document can be linked to other related documents within the same case or other cases within the same jurisdictions; each case can be associated with other cases within the same court and to other cases in other jurisdictions (cases transferred to/from a lower inferior court or higher appellate court or another comparable court); and a filer can now insert a hyperlink within his document submission  to another document in any CM/ECF database within the US federal courts.

### Schedules & Deadlines
Most courts have prescribed schedules (e.g., arraignments, status conferences, pre-trial hearings, appointments, trials) or explicit deadlines that require litigants and parties to respond to previous submissions or events in a case (e.g., a response, answer  or reply to an opposing party's motion or court notice). The CM/ECF program allows automatic generation of dates and times based on court rules and procedures, court activities and docket entries, and permits court personnel to modify and update these dates and times. Various case, judge or court-wide reports (daily, weekly, monthly calendars) and queries (pending deadlines/hearing, pending answers) can be generated.

### Case Flags
The program allows each court to create a unique set of multiple identifiers: to be placed on the front cover of the docket; to be automatically entered or revised based on docketing or court activity in the case; and to produce special reports for any internal case management purposes; e.g., case statuses, lead or special cases, speedy trial, case differentiation.

### Forms & Labels
Court-generated standard forms, orders, notices, and other standardized legal documents are produced based on case and docketing information inserted into a forms template produced by clerical or judicial staff; and these documents are, whenever possible, automatically e-mailed to recipients, or mailed, when necessary, using labels automatically produced by the system.

---

[23] DPF perform a myriad of functions, such as: validating case number and case title; adding, selecting, or removing a participant in the case; displaying pending motions; displaying and editing draft docket text; creating links to other cases and documents; creating, updating, or deleting a deadline or schedule.
[24] CM/ECF validates whether the document conforms to prescribed PDF standards and size limitations established by the court, and will automatically reject improperly prepared electronic documents.

*Financial (Fee) Payments*
Filing fees and other court costs are paid on the Internet either by credit card or online check transactions. When required to pay a fee, CM/ECF seamlessly redirects the filer to the U.S. Treasury; when payment is completed, an automatic entry is made into the case docket for auditing purposes. CM/ECF intentionally avoided creating an integrated financial and accounting program.

*E-Mail Notification*
A Notice of Electronic Filing (NEF) displayed in a standard format is automatically distributed within a few seconds of official docket entry usually by e-mail or by other means[25] to all specified participants in the case. The NEF also replaces the "process of service" that lawyers traditionally had to file verifying that other parties received notice of a submission. The NEF contains the case title, case number, filer(s), docket text, list of recipients, original submitter's file name, unique electronic document stamp created within CM/ECF, and a docket document number with a hypertext link to the document(s) within the docket sheet in the court's database. Each recipient is permitted to view and, if desired, download the document(s) at no cost.

*Transfer of Cases & Documents Among Courts*
Case dockets, documents and data can be electronically transferred between and among courts.

*Reports & Queries*
CM/ECF contains over 150 standard reports classified into over thirty categories. The greatest demand is for the case docket report containing the cover page that lists basic case information, including participants (parties and counsel), followed by docket entries listed in chronological order with the synopsis of the entry or event, and the appropriate documents or forms associated with each docket entry. The number, type, and style of reports will vary depending on court needs but should include: local and national statistical reports; case indexes separately classified by civil, criminal, appeals and other types of litigation (e.g., sealed case) or unique statuses (see case flags function); court activity reports such as trials, hearing, motions, orders, written opinions, judgments issued; judicial case assignment and case status reports, daily, weekly and monthly court calendars; and case scheduling, hearings and case deadlines reports. Most reports include an extensive set of selection options to permit all users to precisely retrieve what they need and when they need a report. Preferred default options automatically appear on most selection screens, but the user is permitted to modify them. Court units are also provided a report writer to create unique local reports.

*Court-Wide Specific Site and Codes Tables*
Program options permit each jurisdiction to modify and control how and what information is provided. CM/ECF offers court-specific options and court codes tables to allow each jurisdiction to regulate how CM/ECF performs in accordance with local rules, policies, and preferences; for example, screen displays (e.g.; size, colors, and fonts), automatic numbering and display of basic case information, case opening procedures, court name, locations, and contact information, maximum size of e-document submissions, warning messages, restrictions to access sealed or confidential information, party roles.

*Quality Control*
Elaborate editing and utility options are available only to designated administrative court personnel. The role of a deputy clerk has been transformed with former data entry tasks replaced by editing and case management tasks to ensure that the electronic entries and documents submitted by filers conform to court procedures and standards.[26] Other utility functions are restricted to a few specialized administrative personnel or technicians who handle the most sensitive information.

*Access Groups & User Accounts*
There are multi-layers of access restrictions depending on each individual's legal status (e.g.; judge, clerk, attorney), involvement in a particular case (e.g.; judge, plaintiff, defense, prosecutor, counsel), group permission (judge's staff, clerical staff, attorneys of record), and special permission. Access can be restricted, if needed, by case, docket entry, and/or document(s) for sealed, ex-parte, or private court-only viewed entries.

---

[25] Some courts allow some individuals to request a paper or fax copy of the notification.

[26] Only court employees would edit the basic case file or case docket; they would not make any changes to the legal documents submitted. The e-filer submitter is always notified of improper legal document submissions. Any substantive corrections are reflected in the official case docket with automatic notation as to whom and when the correction was made. In some instances, the e-filer is notified that the filing is rejected and must be refiled into CM/ECF. Error rates (2-3%) are comparable whether original entry is made by attorneys or court personnel.

### *Privacy & Confidentiality: Redaction, Restricted Information*

Judges, court staff, attorneys and the public all access the same CM/ECF data. Most information in the system is public information, but some is not, e.g., juvenile cases, sealed indictments and documents containing trade secrets. Therefore, the system includes features to restrict access to information that should be available only to designated individuals (see *Access Groups and User Accounts* above). Some documents that are accessible to the public contain specific items of information that should be restricted to protect privacy interests, e.g., bank account numbers, Social Security numbers, some medical facts, and names of minor children. When such documents are filed, by court rule, it is the responsibility of the filer to redact that sensitive information. The filer then submits the redacted version of the document that can be viewed by the public and an unredacted version with appropriate access restrictions.

### *Public Access*

Public Access to Court Electronic Records (PACER) is available to any organization or individual who registers for the service via the court-operated service bureau. The service allows a user to access, view and download any case dockets, documents, or audio courtroom recordings from any CM/ECF court, [27] at a nominal cost ($.08 per page ($.10 effective April 1, 2012); no charge for minimum usage; i.e., fewer than 125 pages (150 pages effective April 1 2012) per quarter year; maximum $3.20 per document regardless of size). Court opinions are exempt from any fee. The central PACER service bureau maintains and nightly updates a national locator index that permits a search by name, case number, or nature of the suit (a nationwide case-type classification code) across all trial and appellate court jurisdictions. Case information (dockets and documents) is extracted directly from a court's operational CM/ECF database. [28]

## IV. Description of Key Technical Components

CM/ECF has relied on x86 computer processors (multi-processors and multi-core servers), originally 32-bit Pentium Pro and more recently upgraded to 64-bit Intel Xeon. Each court unit has its own computers with real-time replication of data to various computer server "farms" (now virtual servers on large platforms) located in several locations throughout the USA. A robust and adaptable relational database (Informix, now owned by IBM Corporation) was chosen based on competitive cost and performance analysis. A UNIX-based Linux Distribution Red Hat Enterprise O/S was acquired containing Open Source Software that includes PERL (general, purpose, interpreted programming language), Apache (web-server software), TOMCAT (open source software using Java servlet and JavaServer Pages technologies), and Comprehensive PERL Archive Network (standard modules of software written in PERL). The programming languages are PERL, JAVA and JavaScript. Portable Document Format (PDF, PDF/A) was established in 1996 as the required document format, and free readers/viewers are available for anyone who wants to review and download any CM/ECF legal documents or forms.

User's Workstations, whether within the judiciary or any other CM/ECF user, can be any hardware vendor or third-party provider, any O/S, any telecommunications provider, and can employ any office applications. The user's workstation or device must contain a modern Internet Browser (free), and a PDF reader (free software from various companies). If they need to create documents for submission to any CM/ECF federal court, the CM/ECF users must acquire a PDF "writer" (several highly-competitive commercial products available in various languages).

## V. Explanation for Success: Basic Objectives, Guidelines, and Principles

There was no single technique or process that explains why CM/ECF has been so successful. CM/ECF success is based on a combination of technical (hardware, software, and telecommunications), development and implementation strategies, and non-technical processes and procedures (interim rules and court orders, mentoring, etc.). Several key steps and decisions were taken that were critical in both the short- and long-term success of the project. Some of these techniques are more common today in the computer industry, but they were uncommon when deployed by CM/ECF in the 1990's. Unfortunately, these technical and strategic approaches are still infrequently adopted in most judicial automation projects around the world.

---

[27] Courts have the capability to restrict or seal access to some materials or information.

[28] 75% of the 1.3 million Pacer registrants never exceed minimum usage. The vast majority of paying PACER users are commercial vendors, data resellers, large government agencies, and law firms uninvolved in particular litigation. Lawyers involved in a particular case can download a document at no charge via the NEF. (See "E-mail Notification".)

A. **Key Technical Objectives**

*Preferred Non-Proprietary Software*
Whenever possible, CM/ECF has used a non-proprietary, generic Operating System (e.g.; UNIX, LINUX) with technical vendor support and open source software libraries, and has adopted non-proprietary software and open published technical standards (e.g.; Adobe Corp. PDF, Sun-Oracle Corp. JAVA). Courts do not want to be dependent on a single vendor or consultant firm because of uncertainty about the long-term viability of the company, and pricing policies.

*Internet-Based Browsers & Connectivity*
All CM/ECF access and functions have used an Internet-based interface, but have insured compatibility with all major browsers and major mobile devices. Developers have wanted to avoid requiring users to install any special software on their personal computers.

*Single Electronic Document Standard*
While the original legal document may be created on whatever device, medium or format desired, all documents must be entered into CM/ECF as a PDF document. This single PDF standard has permitted any recipient of these documents to view and/or reproduce these documents, as originally rendered. This approach has allowed filers total flexibility in the creation of their documents, including traditional paper documents, but has required all filers and the courts to retain and disseminate these documents in one, open-published standard.[29] In circumstances when filers have needed to submit paper documents, the court has electronically scanned the documents into PDF for filing into CM/ECF.

*Application Interfaces*
The initial set of web-pages, menus, screen layouts, and narrative were straightforward. This has allowed the entire legal, court, and public community to more easily learn and comprehend CM/ECF. The organization of menus and categories are based on judicial and legal community perspective. For the more complicated segments of the system, such as full docketing with multiple data entry screens and attaching documents, a self-help option has been offered on each screen; typically, a few hours of training for court and legal personnel is mandatory to insure efficiency and high quality entries. In addition, CM/ECF offers interactive learning modules, on-line training and tutorials, and technical help desks personnel, available during regular business hours.

*High-level of Reliability, Responsiveness, and System Integrity*
Both the judiciary and the legal community expect the service to be available seven days a week, to rapidly respond to inquiries, to permit efficient entry of information without disruptions within a few seconds, and to insure accurate and timely information that cannot be illegally altered or mistrusted. To achieve such standards, court computer installations require redundancy, including redundant power supplies, RAID computer disks, error correcting memories, real-time database replications, failover switching, and reliable internal communications networks. CM/ECF has avoided dependency on any single location or computer complex, and has prohibited any single critical location (hardware or network) to cause a major failure for the entire judiciary. CM/ECF has allowed each major court or regional office unit to operate and maintain its databases. System responsiveness is constantly monitored and responses and screen updates are expected within seconds or fraction of seconds for most reports and queries. CM/ECF development staff has assumed there is no 100% secured computer system and database. Instead, the concept of "layered protection" with a combination of hardware, software, and procedural barriers [30] has been implemented to avoid threats, vulnerabilities, and to protect sensitive data and information from manipulation, improper access, or user identity theft.

---

[29] The US federal courts were the first US government agency to adopt and mandate this electronic document standard, PDF, that over the ensuing years has become the primary e-document standard throughout the world.

[30] The computer system configuration includes (a) inside (database) and outside (user requests or submissions) servers with unique transaction protocols; (b)a separate telecommunication network: Private Judiciary Data Communication Network (DCN); (c) a filtered Intranet that connects courts (DCN) and a public network (PACERNET for public access; ); (d) firewalls between all servers, an intrusion detection system, extensive transaction logs and reports for all accesses and updates, (e) software verification for all documents submitted or replaced, including hash table verification, restricted PDF functions, and PDF verification software; (f) identification of all edited docket and document entries, including the listing of an editorial change noted on the official case docket (date, and submitter name or ID); and (g) multi-layered individual and group profile access levels that specify which activities, cases or documents each individual can access.)

### B. Core Design, Development & Implementation Strategies

The ultimate objective, the total reliance on e-filing, e-files, and automated court case management, has been a radical departure from the traditional paper-intensive manual legal process. However, the development strategy was an evolutionary process that has allowed the court community to constantly test and refine requirements and functions while actually using the service; i.e., an extensive and continuous collaborative arrangement between the developers and users throughout all stages of development and implementation. CM/ECF developers and users did not formulate a grand design and await the completion of all or most components before implementing the service. An incremental application methodology has been used adding new functions and enhancements as more courts implemented CM/ECF. Three parallel project development staffs and user groups were created (appellate, trial, and specialized bankruptcy) using the same core CM/ECF functions[31], but allowing for separate development for crucial components unique to a particular type of court.[32] A small in-house programming staff and court-knowledgeable analysts (five persons) experienced in court automation projects were employed during the early phases of system development and prototyping.[33] Only after CM/ECF was proven effective and viable in test courts did the judiciary rapidly expand staff and consultant resources (both central and locally) for the duration of CM/ECF implementation.[34]

The CM/ECF software and hardware architecture has assumed an integrated approach requiring all key components such as e-filing, e-files, e-docket, e-noticing, electronic case management, and electronic public access to be combined into one database and service. The e-filing, docketing, and case management components were designed to allow courts to easily modify the process. These changes were necessary due to major local rule, policy, or procedural modifications, or to new or revised national government requirements or regulations.

High service standards have been established that ensured the judiciary and legal community confidence and reliance in CM/ECF. These standards include the availability and reliability of service (24 hours /7 days a week, 99.9% on-line, particularly during court business hours); extensive backup and replication; fast, valid and transparent access to court case information, regardless of user's location; full integrity of the information and documents; and equal and immediate public access to public available information.

### C. Critical Non-Technical Principles

#### Court User Development Committees
Individuals involved in defining and assessing CM/ECF requirements were a heterogeneous group composed of judges, administrative staffs (both head administrators and lower-level supervisors), and technicians, representing divergent regions and court sizes. The composition of the group would change frequently, typically bi-annually. These advisory committees were required to establish priorities and clearly differentiate between basic needs and wants. Separate groups were created for different courts (e.g., bankruptcy, general trial courts, and appellate courts) since case management requirements and functions substantially differed. Early CM/ECF prototypes and pilot courts were restricted for several years to civil and specialized bankruptcy courts where case volumes were high, legal and constitutional and political barriers were modest, and the values of e-filing, e-files and an integrated case management system were most beneficial and cost-effective to the courts, litigators, and the public.[35]

#### Evaluation & Deployment
For each type of court, a moderate number of court units (four to five) were involved in the early years of development and testing of CM/ECF. These courts were required to install, train and operate the new system in actual court operations, not just review and test a product and service in an experimental or demonstration status. Both court personnel and technical AOUSC developmental staffs were prepared to regularly make

---

[31] For example, docketing, access control, e-notification, public access, forms, docket reports, scheduling.
[32] For example, specialized bankruptcy courts required a very specialized noticing module to distribute tens of millions of electronic and paper notices each month; trial courts handling criminal cases required specialized speedy trial and magistrate modules, and appellate courts required specialized judicial panel assignments and staff attorney modules.
[33] Developers believed that the extensive court experience of this group was the critical factor for the success of CM/ECF.
[34] Also See "8 Rules of E-filing" by Jim McMillan, National Center for State Courts, 2011 which describes key implementation policies and practices
https://docs.google.com/viewer?a=v&pid=explorer&chrome=true&srcid=0B_GkWI6S9MJMZTc5ZThhNGItZTBhZi00MDAxLThhZWYtN DRhNTYwNGVjYjYmQx&hl=en_US
[35] This approach is contrary to many court automation projects that emphasized the appellate and criminal courts.

adjustments and enhancements to the system, as needed. [36] As additional court units committed to adopt CM/ECF, AOUSC prescribed a timetable for the installation, testing, data conversion, training of personnel, and anticipated operational "live" dates, with some adjustments depending on local circumstances.

### Mentoring & Training Program
As the program expanded, well-structured training and implementation guidelines and mentoring programs were developed. A comprehensive set of guidebooks, checklists, and training manuals were developed, and a centralized CM/ECF service center staff was established. [37] A mentoring program provided each court newly enrolled in CM/ECF with experienced court staffs from earlier CM/ECF adopter courts and other experts (AOUSC administrators, technicians, and consultants) to regularly assist and provide guidance during CM/ECF deployment. Forums have also been established to allow CM/ECF courts to regularly meet and exchange best practices and ideas to enhance the service. Several videos have been created to explain to the legal community the benefits and value of CM/ECF. [38]

### Interim Court Rules & Procedures
E-filing and electronic court records were novel experiences for both the judiciary and legal community, particularly in the initial years of adoption. The AOUSC has generated national guidelines and sample documents outlining the suggested changes in court procedures and rules. In addition, courts have created interim court rules and orders detailing local court practices and refinements. [39]

### Incentives for Early Adopters
Selective incentives were offered to lawyers and organizations who were early adopters and regular participants in the e-filing service. For example, counsels were offered extra services and more convenient hours to accomplish courthouse duties and meetings with judges. Early court adopters were given special recognition, and their leadership offered opportunities to become experts and mentors to other jurisdictions. In some cases, additional personnel, equipment and telecommunication services were provided to these early adopters. Legal and judicial authorities often view the legal process to be a "net-zero sum" process; i.e., one adversary wins while the other side loses; e-filing and e-court technology were proven to provide benefits and gains to all participants in the legal process.

### Financial Support
CM/ECF avoided the total reliance on government funding for all development and maintenance. The judiciary recognized the long-term need for supplemental revenues. The US Federal Courts obtained Congressional legislation to permit moderately priced PACER fees with the requirement that revenue be invested in additional refinements and expansion of public access services and CM/ECF. [40]


## VI. Conclusions

CM/ECF has met all of the goals that were initially set out for the system. Court documents are now delivered, filed, retrieved and managed electronically. Court staffs have been relieved of much of their data entry work. Attorneys have been relieved of their noticing work and now receive immediate notice whenever activity occurs in their case. All users—the court, the bar and the public—are benefitting from immediate and convenient access to court records. The ultimate **CM/ECF goals that have been achieved are (1) that the entire federal court community—judges, administrative** personnel, lawyers, and public users— be completely comfortable in totally relying on this integrated automation service, and (2) that CM/ECF be the official record of all court records, with the vast majority of documents and case information entered and accessed via the Internet.

---

[36] The CM/ECF approach differed from typical court development projects that insist on developers constantly making revisions and enhancements before the service is actually operated in real court settings. The CM/ECF approach encouraged more practical and value-oriented requirements.
[37] See http://www.pacer.gov/ecfcbt/dc.
[38] See http://www.uscourts.gov/FederalCourts/CMECF.aspx.
[39] For example, see Federal Civil Filing Rule http://www.law.cornell.edu/rules/frcp/rule_5; see local civil rule http://www.nysd.uscourts.gov/ecf/rules_040411.pdf.
[40] See http://www.law.cornell.edu/uscode/html/uscode28/usc_sec_28_00001913----000-notes.html.