Winter 1999

Digital Recording of Real Estate Conveyances

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SYMPOSIUM

THE ROBERT KRATOVIL MEMORIAL SEMINAR IN REAL ESTATE LAW

DIGITAL RECORDING OF REAL ESTATE CONVEYANCES

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During the past 350 years, little has changed in the way real estate conveyances are recorded in America.[1] The system we use was developed in an agrarian society with a small population. Real estate recording has been forced to expand to serve counties with millions of residents and hundreds of thousands of land parcels. It has, unsurprisingly, failed to work effectively, and has been largely supplanted in practical operation by private "title plants,"[2] operated by title insurance companies.

Today we are faced with an unprecedented opportunity. We can make the public recording system functional once again. We can take advantage of its natural economy of scale and make the

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1. *See* George L. Haskins, *The Beginnings of the Recording System in Massachusetts*, 21 B.U. L. REV. 281, 282-88 (1941) (outlining the early history of American land title recording); THOMAS E. ATKINSON ET AL., AMERICAN LAW OF PROPERTY 527 (A. Casner ed. 1952) (discussing the early history of recording acts). These sources disclose that in the Plymouth Colony, the original assignments of land to the settlers were written in the traditional colony records from 1620 to 1623. Haskins, *supra*, at 285-86. The earliest private land transfer was written in those records in 1627. *Id.* at 286. An act of 1636 made this practice official. *Id.*

Recording acts were adopted in the colonies of Virginia (1639), Rhode Island (1638), Connecticut (1639), and Massachusetts Bay (1640). ATKINSON ET AL., *supra*, at 528-30. The Massachusetts statute had most of the features of modern recording statutes, including a requirement of acknowledgment of the signer's signature, a recording of the essential elements of the document (later changed to require that the full text be recorded), and the concept that priority on the record established priority of title, unless possession by another party gave notice of an unrecorded interest. *Id.* at 529.

2. A title plant is a duplicate of the public records, except that it is indexed by land parcel rather than by name.

maintenance of multiple privately-owned title plants unnecessary. We can make recording much easier, faster and less costly. We can eliminate the very serious bottlenecks that the recording system continues to impose on real estate transfers in many parts of the nation.

All of this can be done with the use of digital computing technology that is virtually "on the shelf" today. Accomplishing this goal will require a modest capital investment, and a much greater investment in careful and comprehensive planning—a commodity not always in vast supply when state and local agencies expend funds.

The purpose of this article is to describe how such a revolutionary change in the recording system can take place, and to identify and discuss the major policy issues that must be resolved in order to accomplish it. This change ought to happen. Failure to update the system will result in the continued imposition of unnecessary costs and delays on those who buy, sell, or mortgage real estate in America.

I. INTRODUCTION

The American system of land title records differs from almost all others in developed nations. Our system does not provide citizens with legally binding information about the ownership of land parcels. Instead, it functions much like a vast library in which any interested person may do research. The system gives people who acquire interests in land a strong incentive to record the documents by which they obtain their rights, and it indexes and preserves those documents so that later inquirers can read and study them. In effect, the system says to members of the public, "We won't tell you who owns a parcel of land, but you are welcome to review all of the recorded documents that are held in our archives, and decide for yourself about the land's ownership."

Thus, our system's objectives are modest. It relies on searchers to analyze what they find in the recorded documents and to reach conclusions about the status of the title. Moreover, technological advances have had little effect on the recording system. It continues to preserve and provide information in the same fundamental ways used in the Massachusetts Bay Colony in 1620—by providing searchers with an index to documents based on an alphabetized list of the names of the parties to the documents, and copies of the recorded documents themselves.

Two technological changes have occurred on a broad scale. The first change affects indicies. Indices are now alphabetized by computer, and in many counties are available through a computer terminal rather than solely in book form. In a few highly progressive counties, these indicies are available "on-line" to

members of the public.[3] The second change relates to the method by which records are kept. The text of the recorded documents, originally copied by hand into the records, is now preserved in most counties by photocopying, or by microfilm or microfiche photography.

Although computer-assisted indexing makes the administration of recording offices easier and less costly, it is not of much fundamental importance. With or without computerized name indicies, the business of searching a land parcel's title is well beyond the ability and expertise of most lay people.[4] Search results, even if carefully and knowledgeably procured by a professional, are subject to serious risk of error, since the system has numerous gaps and defects, and often fails to disclose title matters which significantly affect land parcels.[5] Hence, nearly all

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3. For recorders providing indices on line, see *Hamilton County Recorder* (visited Jan. 10, 1999) <http://www.hcro.org>; *Computer Access to Parish Records Now Operational*, BATON ROUGE ADVOC., Oct. 19, 1993, at 2B, *available in* 1993 WL 7097442 (Baton Rouge, Louisiana); Matt Carroll, *State, County Agencies Tapping On-line Revenue; Electronic Data Access Brings Income as Users Pay for Convenience*, BOSTON GLOBE, Jan. 26, 1997, at 1, *available in* 1997 WL 6239627 (Middlesex South, Massachusetts); Bill Lubinger, *Knowing Your Neighbors Easy With Digitized Data*, CLEVELAND PLAIN DEALER, Sept. 22, 1995, at A1, *available in* 1995 WL 7131586 (Cuyahoga County, Ohio) (describing availability of data on CD-ROM); *Real Estate Records Available by Computer*, HARTFORD COURANT, July 24, 1996, at B4, *available in* 1996 WL 10381697 (Hartford, Connecticut); Leslie Ellis, *County Clerk's Records Now on the Internet; Filings Can Be Viewed - But It'll Soon Cost*, LOUISVILLE COURIER-J., Jan. 14, 1998, at 01N, *available in* 1998 WL 2095807 (Louisville, Kentucky); Will Higgins, *County Recorder to Go Online; Service Would Speed up Real Estate Research*, INDIANAPOLIS NEWS, Feb. 10, 1995, at B07, *available in* 1995 WL 3034936 (Marion County, Indiana); Robert E. Misseck, *Streamlined Title Search Offered*, NEWARK STAR-LEDGER, Sept. 17, 1993, at 27, *available in* 1993 WL 3487251 (Union County, New Jersey); Bill Walsh, *No More Paper Chase at Clerk of Court's Office*, NEW ORLEANS TIMES-PICAYUNE, Dec. 16, 1992, at B1, *available in* 1992 WL 10949990 (Jefferson Parish, Louisiana).

Virtually all of the systems mentioned provide access only to the indicies, and not to full copies of the recorded documents. The Salt Lake County Recorder's Office is presently developing a system that will provide both on-line. *Projects in Progress: On-Line Records, Salt Lake County Utah*, CT. TECH. BULL. (Sept./Oct. 1997) <http://www.ncsc.dni.us/NCSC/tis/CTB/SALTLAKE.HTM> [hereinafter *Projects in Progress*].

4. For an excellent overview of the operation of American recording statutes, *see generally* Taylor Mattis, *Recording Acts: Anachronistic Reliance*, 25 REAL PROP. PROB. & TRUST J. 17 (1990); Ray E. Sweat, *Race, Race-Notice and Notice Statutes: The American Recording System*, PROB. & PROP., May/June 1989, at 27 (providing an overview of and suggesting remedies for problem areas in the American recording system).

5. The system's defects are outside the scope of the present article, but have been widely discussed. *See, e.g.*, Ted J. Fiflis, *Land Transfer Improvement: The Basic Facts and Two Hypotheses for Reform*, 38 U. COLO. L. REV. 431, 453-54 (1966); Ralph L. Straw, Jr., *Off-Record Risks for Bona Fide*

searches are done by professionals—either lawyers (who are usually acting as agents for title insurance companies), or title insurance company employees. Title insurance has the advantage of spreading the risk of loss from defects in the system and of errors in searching and interpretation among all insureds, rather than allowing it to fall, with potentially devastating effect, on individual land purchasers.

In most large urban areas, public records are cumbersome and searching in them is inefficient. One reason for this problem is the fact that, except in six states and some cities or counties in five others,[6] the records are generally indexed only by the names of the parties to a document, rather than by the parcel or parcels of land it affects. Name indicies are relatively easy to create, but notoriously difficult to use. Hence, urban title insurance companies or agencies usually build their own private title plants in which to perform their searches.[7] A title plant is, in essence, a duplicate of the public records, except that it is indexed by land parcel rather than merely by name. Hundreds of these private replicas of the public land records exist throughout the nation.[8]

Purchasers of Interests in Real Property, 72 DICK. L. REV. 35, 67-72 (1967); Robert L. Stroup, *The Unreliable Record Title*, 60 N.D. L. REV. 203, 203 (1984).

6. Note, *The Tract and Grantor-Grantee Indices*, 47 IOWA L. REV. 481, 481 n.3 (1962) (noting that states with tract indicies in all counties include Nebraska, North Dakota, Oklahoma, South Dakota, Utah, and Wyoming). States permitting tract indexing on a county-option basis include Kansas, Ohio, Wisconsin, and Minnesota. *Id.* New York City has a "block index" system. *See* Robert L. Sweeney & Patricia K. Hart, *Real Property & Real Estate Transaction,* 44 SYRACUSE L. REV. 471, 492 n.179 (1993). Nassau County, New York, also maintains a tract index, but its attempt to do so without computer assistance led to a virtual breakdown of recording in the early 1990s. Celeste Hadrick & Brian Donovan, *County Clerk's Chaos Backlog Worsens at Nassau Office*, NEWSDAY, July 27, 1992, at 4, *available in* 1992 WL 7546999. Similarly, conversion to a computerized tract index in Middlesex County, New Jersey initially resulted in major delays. Joe Malinconico, *Clerk's New Computer Blamed for File Backlog; Title Searchers Fear Errors in Middlesex Could Prove Costly*, NEWARK STAR-LEDGER, July 12, 1998, at 27, *available in* 1998 WL 3430008.

7. Geoffrey Richards, *Who's Who in Title Insurance Explains the Keys to Success*, NAT'L REAL EST. INVESTOR, Dec. 30, 1997, at 72, 74-75, *available in* 1997 WL 16674723. When an efficient tract index is maintained by the public recorder's office, private title plants are unnecessary. For example, the author's home county (Utah County, Utah) has a modern computerized tract index. There are about 30 title companies operating in the county, and none of them uses a private title plant. The efficiency of the public records makes market entry by additional title companies relatively cheap and easy.

8. *See, e.g.*, *id.* at 72-76 (discussing the operations of the computerized Attorneys' Title Information Data System in Florida). Numerous advertisements from computer vendors seeking opportunities to assist title insurers in creating or upgrading private title plants are found in publications such as *Title News,* published by the American Land Title Association of

But aside from the fact that their indices are parcel-based and that they rely somewhat more heavily on computerization of the indicies, they are not significantly different from the public systems that they have copied.

The lack of modernization of public land title records in America is disheartening, particularly in light of the highly creative work performed in the United Kingdom[9] and several Canadian provinces.[10] Land title records in these countries are increasingly available on-line. However, those jurisdictions all use

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Washington D.C., and *Title Technology*, published by Condell & Co. of Hilton Head Island, South Carolina. *Id.* at 76, 78.

9. In the United Kingdom, 15 million registered titles are already computerized and available on-line, and it is anticipated that by the year 2000 all registered land in England and Wales will be on the system. HM Land Registry, Press Notice, *Land Registry Puts Its On-Line Services on Show* (June 2, 1998) <http://www.dmercer.mcmail.com/lrp1198.htm>. The on-line program is called "Direct Access." For further details, see *Direct Access Service* (visited Oct. 21, 1998) <http://www.open.gov.uk/landreg/dasmain.htm>.

In Scotland, the comparable system, called "Registers Direct," is operated by Registers of Scotland Executive Agency. *Registers Direct* (visited Oct. 21, 1998) <http://www.open.gov.uk/ros/hotnews.htm>.

10. In British Columbia, the on-line service includes: registered owner(s) names, historical title information (back to the date when information was first computerized), and reference codes which identify any encumbrances that are contained on the search. Details of encumbrances such as mortgages and easements, are available through the Land Title Document Retrieval system. You may have copies sent to your fax machine. *About the Services* (visited Oct. 21, 1998) <http://www.bconline.gov.bc.ca/htdocs/about_the_services.html>.

In Alberta, some historical titles are available on the Alberta Land Titles Automation (ALTA) system while some are on microfilm, or microfiche, depending on when the titles were canceled. *Alberta Registries: Information Page* (visited Oct. 21, 1998) <http://www.gov.ab.ca/ma/reg/lt/copies.htm#ObtainingCopiesofCurrentTitle>.

Ontario is currently implementing an extremely ambitious on-line title registration system, termed POLARIS (Province of Ontario Land Registration Information System). The computer work has been contracted to Teranet, a Canadian computer company. Michelle Bastarache, *From Months to Moments: Teranet speeds up land registration in Ontario*, 14 INTERGRAPH INTERVUE MAG. 1 (1995) <http://www.ingr.com/intervue/q295/textq2_8.htm>. Ontario's system will soon feature an enhanced land registration system that will make records searching in the land registry office quick and painless. With a new service called Teraview, clients will be able to access the abstract indicies online from remote computer terminals and retrieve digital document images for parcels anywhere in the province. Eventually, remote document filing will also be available. *Id.*

See Electronic Registration (visited Jan. 18, 1999) <http://www.teranet.on.ca/PRODUCT/A-15.html> (providing Teranet's own description of the project). *See also* Gerry Blackwell, *Teraview—Ontario's New Searchable Electronic Land Registry*, CANADIAN LAW., Jan. 1997, at 32 (discussing Teraview software, which provides access to land registry information in Ontario); *The Extent, Appropriateness and Potential of GIS Used in Teranet Company Package for LIS* <http://mscgis.geog.le.ac.uk/97-saj9/Teranet.html> (describing Teranet's land mapping services for the Province of Ontario).

"Torrens" or registration systems, in which the government issued certificate of title is a binding statement of the land's title. For this reason, title examiners there have far less need to reconstruct historical chains of title or to review the content of the underlying conveyancing documents. Hence, implementation of a computerized on-line system of title records is somewhat easier than in the United States.

II. THE PROPOSAL: AN OVERVIEW

This article proposes a new paradigm for public land title records, based on new technology. However, it does not propose a different function for those records. For readers unfamiliar with the difference between the American recording system and the title registration systems other countries use, a brief explanation at this point may be helpful. As noted above, the American system simply involves the *recording* (literally, the copying), indexing, and preservation of documents that affect land titles. Throughout the rest of the developed world (including Canada, Latin America, and most of Europe and Asia) government title *registration* offices operate. Foreign recording offices do not merely copy and preserve documents; instead, they actively make legally binding representations to members of the public about the state of the title to land parcels. In a *registration* system, the government tells one who inquires about a land tract who owns the land, and whether it is subject to any encumbrances. The government's statement is typically legally binding, in the sense that the title *is* where the registration office says it is. Obviously, this sort of system requires far greater expertise on the part of the public employees than does a simple recording system.[11]

While I wish that I could propose and predict that the American recording system will convert into a registration system, I have no confidence whatever that this will occur. The reasons are largely political. The title insurance industry might well be rendered unnecessary if the United States converted to a registration system. At a minimum the industry would lose much of its *raison d'etre*. For that reason, title companies and their associations have steadfastly opposed adoption of registration systems. In addition, the few registration systems in place in the United States today are largely considered too costly and are little used. Some registration systems have also been hotbeds of governmental corruption. For these reasons, expecting or

11. *See* Tim Hanstad, *Designing Land Registration Systems for Developing Countries*, 13 AM. U. INT'L L. REV. 647, 685-86 (1998). Interestingly, Hanstad concludes that, notwithstanding the greater cost and expertise needed to create and operate a title registration system, its superiority is so obvious that it would be nonsensical to establish instead an American-style recording system in a developing country. *Id.* at 657-64.

proposing a wide-scale conversion to a registration system in the United States is sadly unrealistic.

Hence, I propose that we use available computer technology to modernize the existing recording system.[12] The elements of modernization I recommend are as follows:

1. Acceptance of real estate documents for recording in digital text form rather than as paper copies.
2. On-line recording of such documents via electronic mail.
3. Acceptance of digital signatures, rather than ink-and-paper signatures, for execution and recording of real estate conveyances.
4. On-line public availability of the full text of all recorded documents via the World Wide Web or other suitable gateways.

The following benefits are expected to flow from these changes:

1. Substantial reduction in the public costs of maintaining recording offices. Such offices could be consolidated, and conceivably only a single state-wide office would be needed in each jurisdiction.
2. Substantial reduction of the private costs of recording. Title companies, escrow companies, lawyers, and others who record large numbers of documents will save on travel, postage, and messenger costs. They will have virtually instantaneous confirmation that their documents have been recorded. Delays in recording, currently a major problem,[13] will be a thing of the past.

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12. For a number of the concepts discussed in this article, I am indebted to Martin B. Cowen, author of, *Introducing 20th Century Technology to Real Estate Recording Practices (Before the 21st Century Arrives)*, draft of 25 June 1998, presented at the American Bar Association Meeting in Toronto, Ontario (Aug. 2, 1998), and to Public Records: Vision 2000, *Report of the Governor's Task Force on Filing and Recording Land Information* (Dec. 1993), a project of the Governor's Task Force to improve local government filing and recording practices in New York State.

13. Numerous county recorders, in both large and small counties, have been criticized recently for their inability to keep up with the flow of incoming documents. *See, e.g.*, Holly Holland & Andrew Wolfson, *Glitch in County Clerk's Computer Stalls Buying, Selling of Real Estate*, COURIER-J., Apr. 25, 1992, at 01A, *available in* 1992 WL 7832579 (Louisville, Kentucky); Celeste Hadrick & Brian Donovan, *County Clerk's Chaos Backlog Worsens at Nassau Office*, NEWSDAY, July 27, 1992, at 4, *available in* 1992 WL 7546999; Andrew Fegelman, *Bottom of Cook Ballot Still Political Recorder of Deeds, Water District Board Positions Fought Over*, CHI. TRIB., Oct. 20, 1996, at 2, *available in* 1996 WL 2718849 (stating that recorder's opponent alleged it took 17 days to get a deed registered and recorded on the county's computer system when it should take no more than six); Ralph Ellis, *Paper Backlog in Coweta*, ATLANTA

3. Increased accuracy and usefulness of records. Recorded documents can be self-indexing, so to reduce indexing errors by the recorders' staff personnel. It will be possible to search for documents, not only by their indexing information (date, parties' names, land description, etc.) but also through full text searches that can locate any desired word or phrase in the system.
4. Reduction of the risk of recordation of forged documents. Digital signatures, if properly administered, will be much harder to forge than paper documents. Hence, the public records will become more reliable.

I do not suggest that all of these benefits will be available at once, or that they will be easy to achieve. Resolution of a wide variety of legal, technical, and political issues is required in order to accomplish them. This process will take several years. The focus of this article is to identify the issues and to suggest pathways toward their resolution.

III. USING TECHNOLOGY TO CHANGE THE NATURE OF "RECORDING"

I propose in this section a new approach to the "recording" process. To understand the proposed changes, it is first necessary to review the existing system. When a document is recorded, what, precisely, is preserved in the public records? While the earliest experiments with recording in Massachusetts involved only written summaries of the original real estate documents, it soon became the practice to copy into the public record books the entire text of each recorded document. The advantage of this process was the elimination of the risk that the copyist would incorrectly interpret the document, or would omit some material that might prove important to later title examiners.

J. & CONST., Jan. 9, 1997, at M04, *available in* 1997 WL 3948191 (stating that deeds were not typed into the computer system for twoand one-half months).

The Jackson County, Missouri recorder's office was reported to be about three months behind in processing deeds during mid-1998. Eric Cramer, *County Looks at Recorder's Deed Backlog*, EXAMINER (Jackson County, Missouri) (Sept. 1, 1998) <http://examiner.net/archive/index.html>. A recorder from another county who was part of a team sent to Jackson County to evaluate the situation told the author that she saw multiple boxes of unopened envelopes containing documents to be recorded. Telephone Interview with Bettie Johnson, Recorder of Deeds, Boone County, Mo. (Oct. 28, 1998).

Perhaps the most celebrated breakdown occurred in the Philadelphia Recorder of Deeds Office, which was sued by the Pennsylvania Land Title Association in 1997 because of its extreme delays in processing. Bill Yingling, *Slow Filing Prompts Title Insurers to Sue Recorder of Deeds Office*, PHILADELPHIA BUS. J., Feb. 7, 1997, at 8, *available in* 1997 WL 8885860. It took about two months to record documents, about eight months to index them, and about a year to return them to the customer. *Id.*

While the earliest copying was done by hand, most recording offices shifted to mechanical typewriters during the early Twentieth Century, and later to the use of photocopies, microfilm, or microfiche. The latter change eliminated the risk of errors in copying, since title examiners could review mechanical rather than human-created reproductions of the original documents.

Today, nearly all real estate documents originate on the drafter's computerized word processor. The only exceptions (at least among professionals) are simple off-the-shelf instruments in which the parties fill in the blanks, and even these can easily be (and often are) computer generated. Of course, a document may undergo several iterations, including redrafts by several parties to the transaction, before finalization. But in nearly all cases the final document will exist in digital electronic form before it is printed on paper for the parties' signatures.

For this reason it is more convenient for the parties to submit their documents in digital form for recordation. No additional labor is needed to create a digital version of the document; it already exists. Hence, I propose that recorders offices be authorized to accept digital documents. This action will require legislation in most states,[14] since present recording statutes usually presume that the recorder will accept only paper documents.

Digital documents have the advantage of being extremely convenient to transmit. They can readily be attached to electronic mail (e-mail) messages and delivered to their recipients almost instantaneously. The sender can verify receipt very quickly. Consider how the recording of documents by electronic mail would simplify and speed up the recordation process. Today each document must be drafted (usually by word processor); printed; physically signed by the necessary parties; mailed or hand-carried to the recorder's office; stamped with the date and time of acceptance by the recorder; photographed or otherwise duplicated; indexed by the recorder's personnel; placed (as a photocopy or microfilm) in the actual records; and returned (as an original) to the person who submitted the document. If the recorder's office is backlogged,[15] the processing of the document may be delayed by days, weeks, or months.

Electronic recording would be much simpler. The document would be drafted by word processor; signed digitally by the parties; transmitted by e-mail to the recorder's office; error-checked automatically by the recorder's computer; indexed and inserted

14. *See* CAL. GOV'T CODE § 27279.1 (West 1998) (authorizing the recorders of San Bernadino and Orange Counties to accept digitalized images of recordable instruments); 1998 ALA. ACTS 476 (requiring implementation of an improved recording system).

15. *See supra* text accompanying note 13.

into the records automatically; and confirmed as to successful recording by an e-mail message to the submitter. Human intervention at the recorder's office would be rare.

A. Formatting Standards

In any electronic recording system, standardization is necessary for acceptable documents. The recorder cannot be expected to accommodate every conceivable form of digital document. Two very different general forms of recording digital documents can be conceived. One is the recording of a digitized image of the original paper document. Such a digitized image can be obtained simply by passing the document through a scanner. The scanner's output may be referred to as a "bit map," which is a representation of the document by a set of dots arranged in a rectangular form, with some dots being black (representing portions of the document on which ink was deposited) and other dots being white (representing areas of the paper on which there was no ink). A few recorders' offices in the United States have recently begun accepting such scanned documents in lieu of paper copies for recording.[16] A few others have begun scanning their existing recorded documents in order to make them available for examination on line.[17]

Assume, for example, that the pages of the paper document are 8.5 inches by 11 inches in size. Assume also that an image of the document with a resolution of 300 dots per inch will provide sufficient clarity and sharpness to satisfy all reasonable users.[18] A single letter-sized page will have 8.5 x 300, or 2550 dots in the

16. In 1996 the California legislature authorized the recorders of Orange and San Bernadino Counties to accept digitized documents for recordation from title insurance companies. CAL. GOV'T CODE § 27279.1. This authority expires January 1, 1999 unless extended by the legislature. *Id.* Orange County began accepting such documents in 1997, and expected to record more than 200,000 digitized documents during 1998. *Extention of Electronic Recording*, CAL. LAND TITLE ASS'N NEWS, ¶ 1 (Feb. 1998) <http://www.clta.org/CONSUMER/extensio.htm>. 11 title companies were using the service by the end of 1997. *Id.* at 3.

17. *Projects in Progress*, *supra* note 3. The Salt Lake County Recorder is planning to convert approximately 14 million microfilm pages, dating back to 1980, into scanned images. *Id.* On-line access is designed primarily for real estate professionals, such as brokers and title companies, and costs $100 for an initial hookup and a $25 per month fee. *Id.* At this writing, documents have been converted back to May 1994, and the full index of recordings back to 1980 is available. *Salt Lake City Recorder* (visited Nov. 6, 1998) <http://rec.co.slc.ut.us/>. The Hamilton County, Ohio recorder now has scanned copies on line of all documents recorded since June 1, 1988. *Hamilton County Reporter* (visited Nov. 6, 1998) <http://www.hcro.org/index.html>.

18. Three hundred dots per inch was the resolution provided by the first generation of office laser printers, and is widely regarded as quite adequate for business and legal purposes. *See generally* Cowen, *supra* note 12.

horizontal dimension, and 11 x 300, or 3300 dots in the vertical dimension. The total number of dots required to represent the entire page is thus 2,550 x 3,300, or 8,415,000 dots. If no colors or levels of grey need be reproduced, each dot requires only two electronic "bits"—a zero if that dot is white and a one if it is black. Hence the page will require 16,830,000 bits to store. The capacity of computer storage devices, such as fixed disks and floppy diskettes, is usually measured in terms of the number of "bytes" they can store. A byte is composed of eight bits. Thus, our bit-mapped page of 16,830,000 bits can be stored in 16,830,000/8, or 2,103,750 bytes, which is slightly larger than the capacity of the familiar 3.5-inch high-density floppy diskette. In the parlance of computer engineers, it is about "two megabytes," or two million bytes.

The computer file for a page stored in this way would usually be given a file name ending in ".bmp," an abbreviation for "bit-map." There are a variety of methods for compressing such files to reduce the size of the required storage. All of these methods rely on the fact that in ordinary documents, the black and white areas are not distributed randomly. Instead, there are nearly always large white spaces in which no ink appears. Even the inked areas consist of multiple contiguous dots rather than a random scattering of dots. For example, the cross-bar on the letter "A" may be 1/16 of an inch across. At 300 dots per inch, this is about 19 dots. It is obviously less consumptive of computer storage resources to record "one dot, repeat 18 additional times" than to record "one dot" nineteen consecutive times. This is, in essence, what all compression schemes do. Compression methods vary with respect both to the resulting file size and with respect to whether, and to what degree, the clarity and sharpness of the resulting image is degraded by the compression process. In general, the smaller the file size, the greater the potential for degradation. Nonetheless, bit-mapped images can readily be reduced to one-fifth of their original size by compression with virtually no observable loss of clarity. Thus, our two megabyte image file can easily be compressed to about 400,000 bytes (or 400 K, with the "K" standing for kilobytes, or thousands of bytes).

The cost of magnetic disk storage for computers has steadily declined for many years. At this writing, a 10-gigabyte (10 billion byte) fixed disk drive costs about $200, for a cost of about $.02 per megabyte. If each page, as a digitized image, consumes 400 K bytes (or 4/10 of a megabyte), the cost to store each page is about 0.8 cents. A 10-gigabyte fixed disk drive, costing $200, could store 25,000 pages. It is likely that further dramatic cost reductions will continue to occur.

Digitizing paper documents may be a way of saving storage costs, but it fails to take advantage of certain other desirable

benefits that computers can offer. In effect, a digitized document is nothing more than a photocopy of that document, stored on computer media rather than on paper, film, or fiche. An alternate method of storing documents is available that uses much less storage space, and also offers a remarkable range of expanded capabilities for the recording system. This method involves not the creation of a digital picture of the page of text, but rather the storing of each individual character (letter or number) of the text as a "byte" of digital data. The most common and universally-accepted method for storing text characters is the American Standard Code for Information Interchange (ASCII). ASCII was developed many decades ago when computers used punched cards and teletype printers, but it is still widely employed today. Modern word processing programs use proprietary file formats to store information about fonts, layouts, pagination, and the like, but nearly all of them continue to store the text itself in the form of ASCII characters. Moreover, and more importantly, virtually all word processing programs can import, edit, and export ASCII files. The disadvantage of ASCII is that it provides very limited formatting information: tabs, carriage returns, and the like, but little more. Fortunately, highly sophisticated formatting for legal documents is largely unnecessary.

Documents stored as ASCII text require far less storage space that the same documents stored as bit-mapped images. For example, a fairly dense single-spaced page of text contains about 4,000 characters. Since in ASCII each character is represented by one byte of storage space, a page will require 4,000 bytes, as compared with 400,000 bytes when stored as a bit-mapped image. The ASCII form of the document thus requires only about 1/100 the space needed for the bit map. The 10-gigabyte fixed disk drive mentioned above could store about 2.5 million pages of ASCII text. Methods of further compressing ASCII data are available, but ASCII is so efficient in its use of storage space that additional compression is hardly worth the effort.

More importantly, ASCII-based documents can be searched and their data manipulated directly on a character-by-character basis. For example, it is a straightforward task for a software program to search 2.5 million pages of ASCII text and report to the user all documents containing a given word or phrase. That capability is simply impossible for material that is stored in the form of graphic or scanned images.

As noted above, modern word-processing programs use file formats that are not "pure" ASCII, but are "ASCII-based" in the sense that the letters and numbers in the text are represented by ASCII codes, but with many additional proprietary codes being used to establish the document's formatting. This is true of Microsoft Word and WordPerfect, the two most common word

processors currently in use. Hence, a reasonable standard for real estate documentation might be to accept ASCII, Microsoft Word, and WordPerfect documents.[19] This would satisfy the needs of nearly all American business offices. Without doubt, the file formats of the latter two programs, being proprietary, will change over time. However, software to convert files created with older versions of the programs to later versions is likely to be built into program upgrades, and in any event would be simple to implement.

Some real estate documents consist of graphical material in lieu of, or in addition to, text. For example, a recorded deed or lease may include a survey or a plot plan. Subdivision plats must be recorded. Condominium declarations must have attached building plans delineating the individual units. For these sorts of documents, one or more graphical format standards must be adopted for use in recording. Common graphical formats in use today include .gif (Graphical Interchange Format), .jpeg (Joint Photographic Experts Group), and .tif (Tagged Image File Format).[20] As with text formats, software that will convert a file from one graphical format to another is readily available.

B. Self-Indexing Documents

In today's conventional recording systems, an employee of the recorder's office reviews each document submitted for recordation and identifies the relevant information needed to index it. In most states, indexing is performed only on the basis of the names of the parties to the document—grantors and grantees or their equivalents. Hence, the recorder's personnel must discover in each document the names of the parties and determine whether they are granting or receiving land interests through the document. This process is tedious and requires that the names be manually transcribed from the document into the index. Most urban counties now maintain their indicies on computer data bases, but this foray into technology does nothing to make the task of indexing easier or more error-free; it simply permits easier use of the index once it has been created.

Most American recorders do not index on the basis of the land parcel or tract described in the document. From a title searcher's viewpoint, tract indicies are much preferable to name indicies, simply because searchers generally want to discover all of the

19. For example, the Toronto, Ontario electronic filing project for court documents accepts both Microsoft Word and WordPerfect submissions. INTEGRATED JUSTICE PROJECT, TORONTO E-FILING PILOT PROJECT INFORMATION PACKAGE 1, at 5 (1998).

20. *See Computer Graphics* (visited Oct. 21, 1998) <http://www.cms.dmu.ac.uk/~mmc96cs1/compgra/main.html> (providing a convenient summary of the common graphic file formats).

persons with interests in a given parcel, not all of the documents executed by a given person. For that reason, all private title plants that title insurance companies operate use tract indexing.[21] However, tract indexing requires a considerably higher level of skill and training on the part of the recorder's personnel, with a corresponding increase in the public cost. For this reason, recorders have not widely implemented this system.[22]

It is my view that expecting the recorder's personnel to perform indexing is fundamentally inefficient and unnecessary. Instead, documents can readily be made "self-indexing." A self-indexing document is simply one in which the party submitting the document is required to identify and set out the indexing data so that the recorder need not search though the document to find it. To be specific, each document should be required to include a "header": a set of standard fields in which the submitter would provide the indexing information. Such a header might look as follows:

	T.I.N.	**Last Name**	**First Name**
Grantor 1	332-99-4646	Schwartz	Frederick
Grantor 1 signature	87MMNE877FN776544JJ42663		
Grantor 2	466-09-0252	Schwartz	Martha
Grantor 2 signature	65HDBW366ED098777KS0977		
Grantee 1	773-98-6632	Martin	Joseph
Grantee 2	993-84-3441	Martin	Harriett
Grantee cotenancy	TC		
Type of document	034 Grant Deed		
Parcel identifier	334-886-778-901		
Date of document	09-25-98		
Remarks			
Consideration	$109,500		

Even without computer assistance, this sort of header could be extremely useful in ensuring accurate indexing, simply because it isolates and clearly identifies the information needed for indexing the recorded document. With the addition of computer capability, its usefulness is enormously expanded. If the document is submitted in electronic form, the recorder's computer can simply

21. There are, of course, a few types of documents which do not include a tract description, and which can be indexed only by the names of the parties. These include judgments and name changes, for example. Hanstad, *supra* note 11, at 671-72.

22. In most states, the types of indicies to be maintained by recorders are described by statute. Recorders are not often inclined to go beyond their statutory mandates; doing so might generate criticism that they were spending public funds unnecessarily, and might even produce claims of *ultra vires* activities.

identify the standard fields at the head of the document, extract the indexing information from them, and place that information in the recorder's computerized index.[23] No human intervention is necessary.[24]

A rudimentary form of self-indexing headers is already in use by some county recorders. Self-indexing takes the form of a required cover sheet submitted with each document to be recorded, setting forth indexing information of the sort described above.[25] However, the use of this information by recorders is typically not automated, and employees in the recorder's office must still read the information from the cover sheet and manually keypunch it into the index. Nevertheless, the cover sheet is a useful step toward automated indexing.

Gaining the greatest advantage from automated indexing depends on the adoption of two additional innovations described in the following two sections: standardization of documents and adoption of land parcel identifier numbers.

C. *Standardization of Documents*

In most American jurisdictions, there are perhaps twenty or thirty form documents that account for the vast bulk of real estate recordings. These include warranty and quitclaim deeds, mortgage assignments and releases, claims of mechanics liens,

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23. I made a similar suggestion 25 years ago, but at that time the notion of submitting documents for recordation in electronic form made no sense; word processors were rare and existed only in an extremely rudimentary state. Hence, I suggested that the header be submitted on paper with the use of a type font that could be read by an optical character recognition (OCR) scanner, and could then be placed into a computerized index. *See* Dale A. Whitman, *Optimizing Land Title Assurance Systems*, 42 GEO. WASH. L. REV. 40, 53-55 (1973). The advent of widespread word processing and electronic mail today means that an OCR scanner would no longer be needed; the digital document could be read directly by computer.

24. Except, of course, in cases in which the header information in the submitted document was erroneous or garbled, or for other reasons did not meet the recorder's standards. *See infra* text accompanying note 31.

25. WASH. REV. CODE §§ 65.04.045, 65.04.047 (1998) (requiring that the cover sheet (or space on the first page of the document itself) contain the following information: the title of the document, indicating the kind transactions involved; reference numbers of any documents being assigned or released; the names of the grantors and grantees; an abbreviated legal description of the property, and a reference to the document page number where the full legal description is included, if applicable; and the assessor's property tax parcel or account number); WIS. STAT. ANN. § 59.43(2m) (West 1998) (permitting county recorders (termed "registers of deeds") to require persons submitting document to attach a cover sheet giving the document's title, return address, and parcel identifier number).

The movement toward use of such cover sheets has been encouraged by the National Association of County Recorders, Election Officials and Clerks. Telephone Interview with Bettie Johnson, *supra* note 13.

and the like. The standard mortgage or deed of trust forms prescribed by the Federal National Mortgage Association (FNMA) and the Federal Home Loan Mortgage Corporation (FHLMC) fall into the same category.

Each year in populous counties, thousands of these forms are recorded. Except for information about the parties, the land affected, the mode of taking of title, and the date, all of the forms of a given type are identical. For example, the version of the FNMA/FHLMC residential mortgage form that is printed and recorded is generally four pages long. In a populous county with, say, 10,000 new residential mortgage transactions in a year, the result is the recording of about 40,000 nearly identical and unnecessary pages.

The great bulk of this redundancy could be eliminated if a set of standard forms were adopted and recorded as "master" forms. Each individual document could then simply adopt by reference the content of its corresponding master form. If the "header" concept illustrated above were employed, the header would need only to state the number of the master form it incorporated—as in the reference to "034 Grant Deed" in the example header above.

In a few states this practice is already followed to a limited extent. For example, California law permits the recording of certain types of "fictitious" documents which can then be incorporated in real documents.[26] But there is no reason that all commonly-used forms could not be given the same treatment. Doing so would avoid placing an enormous amount of unnecessary clutter in the public records. For purposes of giving the parties a written record of the content of the document they have signed, the attorney, title company, or escrow company procuring their signatures could routinely hand them a photocopy of their header with the incorporated document stapled to it.

Bringing such a system to fruition would require the cooperation of several groups. Depending on the state's political structure, those participating in developing and approving a set of standard forms might include the Attorney General, the state bar, the state land title association, the real estate commission, and others. Reaching a consensus should not be difficult, and implementation of the concept should require at most a simple and noncontroversial statutory amendment. If the master document concept were combined with the computerized "header" concept discussed earlier, the amount of recorded paper, or the digital equivalent of paper, would be enormously reduced, while at the same time the task of title examiners would be vastly simplified.

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26. *See, e.g.*, CAL. CIV. CODE § 1219 (Deering 1998) (recording of oil and gas leases); CAL. CIV. CODE § 2952 (recording of fictitious mortgages or deeds of trust).

D. Land Parcel Identifier Numbers

During the past several decades, many counties in the United States have engaged in comprehensive mapping programs. These efforts were motivated primarily to ensure that all parcels were on the tax rolls, and that their valuation was reasonably accurate. However, mapping programs have had many side benefits as well. The maps often show zoning, flood plains, type of land use, access to public facilities such as city water and sewer systems, and a variety of other data. These data are useful to county and city engineers, emergency response teams, and other public officials. Increasingly, private firms are also benefiting from land-parcel-based data in increasing the effectiveness of their marketing programs.[27] A comprehensive set of mapped data of this sort is usually termed a "geographic information system" (GIS)[28] or a "cadastral" system.[29]

County-produced maps usually assign a unique identifier number to each land parcel, and they correlate this number with the parcel's record owners and its legal description. In many cases, counties have used the mapping process as an occasion to resolve overlaps, gaps, and other discrepancies in boundary descriptions. The resulting maps are usually digitized and made available to local government officials by means of dedicated terminals. In some cases, progressive counties have also provided public access to the maps via a dial-up on-line system or even by means of the Internet.[30]

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27. *See* Harlan J. Onsrud & Robert I. Reis, *Law and Information Policy for Spatial Databases: A Research Agenda*, 35 JURIMETRICS J. 377, 385 (1995).

28. *Id.* at 380. *See* Scott D. Makar & Michael R. Makar, Jr., *Geographic Information Systems: Legal and Policy Implications*, 69 FLA. BUS. J. 44, 44-45 (1995) (defining GIS as a "software program which performs various calculations and functions using compilations of physical, geographic or demographic data"). *See generally* Michael P. Conzen, Book Review, 92 MICH. L. REV. 1637 (1994) (reviewing ROGER J. P. KAIN & ELIZABETH BAIGENT, THE CADASTRAL MAP IN THE SERVICE OF THE STATE: A HISTORY OF PROPERTY MAPPING (Univ. Of Chic. Press 1992)).

29. "A cadastre is a systematically organized database of property data within a certain jurisdiction. This information is based on a comprehensive survey of a property's boundaries." Hanstad, *supra* note 11, at 646 n.13, 651 (1998) (citing to GERHARD LARSSON, LAND REGISTRATION IN DEVELOPING COUNTRIES 20 (1991)).

30. One of the best examples is Greene County, Ohio (county seat Xenia, Ohio), found on the Internet. *Greene County Geographic Information Systems* (visited Feb. 3, 1999) <http://www.co.greene.oh.us/gismapserver.htm>. This site is exceptionally well implemented. It is possible to begin with an overall map of the county, zoom in to any desired level of detail, click on a particular land parcel, and immediately view a wide range of information about that parcel, including: parcel identifier number; owner(s) name(s) and address; deed recording information (book and page number); acreage of site; year improvements were constructed; legal description; tax assessment information; information on improvements (square footage, bedrooms,

The parcel identifier numbers on these maps can readily substitute for conventional legal descriptions, provided that the maps meet reasonable standards for accuracy and completeness. For a parcel identifier number to serve as a description, there must be a one-to-one correspondence between the number and the conventional legal description. This correspondence might be established by the county's creation of a computerized "look-up table" relating the two forms of description. Of course, the public officials who maintain the system must be firmly committed to preserving the parcel numbering system, avoiding the use of the same number for more than one parcel, and continually updating the system as parcels are subdivided and merged. If this is done, legal descriptions based on parcel identifier numbers are perfectly acceptable, and can be used in a document "header" of the sort described above. They are much shorter, and consequently much less prone to inadvertent copying error, than conventional land descriptions. Computers can handle parcel identifier numbers in a much more straightforward manner than conventional descriptions, since the latter may be correctly expressed in a number of different ways, using different abbreviations and word orders, while the parcel number for a given tract of land will always be the same.

E. The Recording Process

If the elements described above (standardized digital formats for documents, standardized headers, standard forms, and descriptions by parcel identifier number) are in place, the recording process itself can be vastly simplified. The following is an overview of the way it might work:

1. The recorder's office receives a document via e-mail or delivery of digital media (a floppy diskette, CD-ROM disk,

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bathrooms, basement, fireplace, construction type, utilities, type of heating); parcel frontage and depth; price at most recent sale.

Searches can also be made by name of owner, by address, and by parcel identifier number. In addition, aerial photographs of all parcels in the county are available via the Internet. The county's web site contains the following disclaimer: "The information contained on this cadastral map is used to locate, identify and inventory parcels of land in Greene County for appraisal and taxing purposes only and is NOT to be construed or used as a 'legal description'." *Id.*

The disclaimer was probably included by the county attorney to avoid the risk of county liability for errors in the mapping system that might result in land boundary disputes if used in conveyancing documents.

The system also includes an interesting "notification" feature, which will identify the owners of all parcels within 300 feet of a given tract of land. This is useful for persons who need to give notice of a proposed zoning change or other administrative action.

etc.)

2. The recorder's computer analyzes the header and checks for errors. Common errors[31] might include the following:
   a. Essential fields in the header are missing (e.g., no grantor or grantee, no indication of the type of document, etc.)
   b. The digital signature of one of the parties is not authentic (a matter discussed below).
   c. The parcel number does not correspond to any valid parcel in the recorder's jurisdiction.
   d. The grantor appears to have no legal interest in the described parcel, based on existing recorded documents.
   e. The form number given is not one of the approved standard forms.
   f. The grantor's signature does not correspond to the signature of a previous grantee of the parcel.[32]
3. If an error is identified, an e-mail message is immediately sent to the submitter, advising that the document is not recordable and explaining the nature of the error. In some cases, the error may be a subtle one that requires individual attention by a member of the recorder's staff, and perhaps a hand-tailored message to the submitter.
4. If no error is identified, the body of the document is placed in the recorder's permanent data base and the information in the header is placed in an index file linked to the document body. An e-mail message is dispatched to the submitter, confirming that the document has been recorded.

For the vast majority of document submissions, no human intervention would be required in such a system. The system would eliminate faulty indexing resulting from human copying errors. Delays would not occur, and a confirmation of successful recording would ordinarily be returned to the submitter in a matter of seconds or minutes. Title failures resulting from the fact

31. Depending on the detailed implementation of the system, a variety of other sorts of errors are conceivable. For example, if digital signatures of grantees are required, the absence of such a signature would warrant rejection of the document. *See infra* text accompanying note 59.

32. This sort of error check can be made only if grantees' digital signatures are routinely required on deeds. *See infra* text accompanying note 59. Statutory change will need in most states to permit rejection of a proffered document on this basis, since it is usually held that recorders have no authority to reject even a document that is obviously invalid or a nullity. *See* Proctor v. Garrett, 378 N.W.2d 298, 300 (Iowa 1985) (holding that a recorder had no discretion to reject the recording of a "common law lien" even though it was a legal nullity).

that some adverse interest was placed on record between the time the purchaser's title search was last updated and the time of recording would be virtually eliminated, since the purchaser's lawyer or title company could update the search and record the purchaser's own conveyance almost simultaneously.[33]

F. Impact on the Searching of Titles

Both the indexed data and the full text of the recorded documents (insofar as they are in textual format) should be made freely available to the public via hard-wired terminals in the recorder's office, dial-up modem access, and the world-wide web. Hence, in the long run, no title search would require the searcher to leave his or her office or visit the recorder's office.

The present-day distinctions between tract indicies and name (grantor/grantee) indicies would disappear. Searches could be made on the basis of any or all of the header fields: name, parcel identifier number, type of document, date, and so on. Since the full text of all recorded documents would also be available, full-text searches of document content (such as those lawyers now make on Lexis and Westlaw) would also be possible. For example, a searcher could look for "all warranty deeds recorded during January, 1999 with Ajax Real Estate as the grantor and the word 'condominium' in the body of the deed."

IV. DIGITAL SIGNATURES

When a party signs a real estate document, the signature performs at least three important functions: first, it impresses on the signer that she or he is doing an act of legal importance; second, it helps to authenticate the identity of the signer; and third, it indicates the signer's approval of the content of the document.[34] Of course, a visual inspection of a hand-written

33. The problem of the "gap" between title update and recording is well illustrated by Prochaska v. Midwest Title Guar. Co. of Fla., 932 P.2d 172 (Wash. Ct. App. 1997). A "gap" between title update and recording occured when a judgment lien was placed on record nine minutes before the purchaser's deed was recorded. *Id.* at 173. The court held that the purchasers had constructive notice of the judgment, were not bona fide purchasers, and took title subject to the judgment lien. *Id.* at 176. In a conventional paper recording system, the judgment obviously would not have been indexed by the time the purchasers' deed was recorded, and could be located only by a searcher's manually thumbing through the stack of documents awaiting indexing. In counties with seriously backlogged recording systems, that stack might have hundreds or even thousands of documents in it. *See supra* note 13 and accompanying text.

34. Information Security Committee, Section of Science and Technology, American Bar Ass'n, *Digital Signature Guidelines: Legal Infrastructure for Certification Authorities and Secure Electronic Commerce* (visited Feb. 3, 1999) <http://www.abanet.org/scitech/ec/isc/dsgfree.html> [hereinafter ABA

signature is a rather poor authenticator of identity, and forgeries are common. The authentication function is thought to be enhanced somewhat by the common requirement of notarial acknowledgment of the signatures of grantors as a prerequisite to recording. However, experience teaches that notaries are often negligent, deceived, or become parties to the forgery.[35]

In principle, it would be possible to design a system of electronic recording like that described in the previous section of this article, but to require that each submitted document be accompanied by a digitally scanned image of the parties' signatures. However, such a requirement would make little practical sense. First, it would offer no advantages over the present recording system, in which hand-written signatures must be submitted. Indeed, the authentication function that is served by signing would probably be attenuated, since a scanned copy of a signature is probably more difficult for a handwriting expert to authenticate than an original signature. There would be a further problem: How could the recorder's personnel be certain that the signer intended the scanned signature to be associated with the particular document submitted? The submitter might instead have scanned a party's signature on some entirely unrelated document and attached it to the real estate instrument in question, much like a forger who photocopies an individual's signature and then pastes the photocopy onto the signature line on a real estate deed. Because of the ease with which digital documents can be manipulated, the improper use of scanned signatures in this manner would be virtually impossible to detect.

Thus, if paperless real estate documents are to be recordable electronically, the preferable approach is to require use of digital signatures in place of conventional pen-and-ink signatures. In its simplest terms, a digital signature is simply a long string of characters (letters and numbers) that has been assigned to an individual and that the individual appends to a digital document to "sign" it. Underlying this simple concept is a wide range of interesting and potentially difficult issues. They include:

1. Who will assign digital signatures to individuals and maintain a record of what digital signature has been

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Report].

35. *See, e.g.*, Bennerson v. Small, 842 F.2d 710, 711 (3d Cir. 1988) (holding that "one cannot take legal title through a forged deed"); Brant v. Hargrove, 632 P.2d 978 (Ariz. 1981) (involving a forgery scenario where a married man appeared before the notary with a woman who signed and acknowledged the deed, but who was not the man's wife and co-owner); Hoffman v. Schroeder, 186 N.E.2d 381, 388 (Ill. App. Ct. 1962) (holding registrar's agent liable to mortgagee for loss where agent failed to recognize discrepancies in imposter's forged signatures).

assigned to each person?
2. How can someone receiving a document with an appended digital signature verify that the signature is in fact that of the person who is purported to have signed the document?
3. How can this sort of verification be accomplished without disclosing the digital signature itself to the person seeking verification. (Such a disclosure, if made, might allow the recipient of the document to use the signature fraudulently in the future.).
4. How can a digital signature be uniquely associated with a particular document, so that when the recipient verifies the authenticity of the document, he or she can also be certain that the received document, without changes, is the document that was originally signed? (A method of uniquely associating the signature with the document is sometimes said to implement the principle of "non-repudiation," since the signer cannot effectively repudiate the document.).

A. Public Key Infrastructure

Public Key Infrastructure (PKI) is currently regarded as the most secure and effective form of digital signature, and one that has the capacity to deal effectively with all of the issues raised above.[36] PKI works as follows. Each person who wishes to sign documents using PKI must obtain a digital ID that consists of two "keys" (strings of characters), a public key and a private key, from a Certification Authority (CA).[37] The CA publishes the public keys and makes them widely available on-line to all.[38] The private key issued to each individual is expected to be held confidentially and securely by that individual. The two keys are mathematically related, but it is "computationally infeasible" for one who knows the individual's public key to derive the private key from it. Only the CA possesses records that connect the public key and private key to one another.

The process of using the private key to digitally sign a

36. ABA Report, *supra* note 34, at 3-20 (containing a complete and thoughtful description of PKI from a legal viewpoint). *See generally* Michael S. Baum & Warwick Ford, *Public Key Infrastructure Interoperation*, 38 JURIMETRICS J., 359, 359 (1998) (discussing PKI and its applications); Brian W. Smith & Timothy E. Keehan, *Digital Signatures: The State of the Art and the Law*, 114 BANKING L. J. 506, 507-08 (1997) (discussing digital signature features of validity, authenticity and security, and urging legal approval of digitally-signed transactions); Information Technology Division, Commonwealth of Massachusetts, *The Basics of Public Key Cryptography and Digital Signatures* (last modified Dec. 19, 1996) <http://www.magnet.state.ma.us/itd/legal/crypto-3.htm>.

37. Smith & Keehan, *supra* note 36, at 508.

38. *Id.*

document works as follows.[39] The document which the individual wishes to sign is run through a computer "hashing" algorithm to produce a "hash code." This code, again consisting of a series of random-appearing letters and numbers, represents the content of the document. It is exceedingly improbable that two different documents would produce the same hash code, or that if the original document were modified, it would produce the same hash code as in its original form. Hence, the hash code acts as a proxy for the document.

The individual who is signing now provides his or her private key to the computer that generated the hash code. The private key and the hash code are bound together and encrypted or encoded to produce the digital signature. The document itself may also be encrypted if desired for privacy purposes, but in the case of real estate documents to be recorded, this step is unnecessary, since the document is intended to become accessible to the public in any event. Now the document and the digital signature (made up from the hash code and the signer's private key) are transmitted by electronic mail (or any other desired form of transmission) to the recipient—in our context, the recorder's office. They may be transmitted together or separately, but if they are separated, it is essential that they identify one another so that the recipient can put them together again. This is necessary because the document without the signature is unsigned, of course, and the signature without the document is simply meaningless.

How does the recipient use the digital signature? By obtaining the signer's public key. It is the nature of the private key that it can be decrypted only with the corresponding public key. All public keys are widely disseminated. The recorder, upon receiving a document for recordation, requests a certificate from the CA. The certificate, transmitted through e-mail, includes the public key, the name of the individual to whom it was issued, and perhaps a statement of the level of security employed by the CA when it issued the digital ID to the individual. The recorder then takes the public key and applies it (through a computer algorithm) to the digital signature on the received document. The recorder also runs the document through the same hashing algorithm used when the document was created, thus deriving the document's hash code. Using the public key obtained from the CA, the recorder can now verify the identity of the person who signed the document and verify that the document received by the recorder is identical to the document the individual originally signed, with no modifications. Thus, the individual who signed the document cannot repudiate it.

This process may seem complex, but it can be carried out

39. See generally *id.* at 507-09 for a discussion of digital signatures.

almost entirely by computer without human intervention. The time required would be limited only by the speed of the e-mail network, and would ordinarily be measured in seconds or minutes at the longest. If the signature was verified to be that of the purported signer and the document was verified to be identical to that originally signed, the document would be immediately recorded; no direct involvement by members of the recorder's staff would be necessary.

B. Advantages and Disadvantages of PKI

The advantages of PKI for recording of real estate documents are obvious. It permits authentication of both the document and the signer's identity with an extremely high level of confidence, despite the fact that the document and the corresponding digital signature are being transmitted over the Internet or other insecure, publicly-accessible networks. Moreover, the system is very difficult to tamper with. A hacker would almost certainly be unable to break into the CA's data base and steal or acquire individuals' private keys. It seems beyond doubt that PKI-based digital signatures would be far less susceptible to fraud and forgery than are the conventional ink-on-paper signatures used today.

However, conversion of the real estate recording system to PKI-based signatures would raise a number of questions. Perhaps the most obvious derives from the fact that relatively few people currently possess CA-issued digital IDs. It would be a simple matter for businesses in the real estate industry to acquire them, but most private individuals are not now aware of the need or familiar with the procedures for acquiring them.

I believe that is likely to change, and to do so fairly rapidly. The reasons grow out of the fact that credit card issuers and other financial service providers incur many millions of dollars in losses each year as a result of false identification. The principal means of identification used today on credit applications, beyond the applicant's signature, is his or her Social Security Number (SSN) or taxpayer identification number. However, it has become extremely easy for unscrupulous persons to obtain the Social Security numbers of those they wish to impersonate. The Lexis-Nexis P-TRAK service provided SSNs as part of its data set on individuals until it was forced to withdraw that information under a storm of protest in 1997.[40] Other, lesser-known services still

40. Lexis-Nexis eliminated the provision of Social Security number information on June 12, 1996. *See* Rose Aguilar, *Service Still Provides Sensitive Information*, CNET NEWS.COM 1 (Sept. 19, 1996) <http://www.news.com/News/Item/0,4,3608,00.html>. According to David Sobel, legal counsel with the Electronic Privacy Information Center, "[i]t's not as if Lexis-Nexis is the first private database to contain Social Security numbers . . . . It's just

provide SSNs to investigators.[41] Individuals routinely give their numbers to public libraries, motor vehicle bureaus, voter registration officials, prospective employers, schools and colleges, utility companies, hospitals, physicians, landlords, and a host of other requesters. In addition, thieves may obtain SSNs simply by digging through garbage, purloining mail, or stealing wallets and purses. The result is that a SSN is an extremely poor means of authenticating identity.

That fact has led to an epidemic of "identity theft," in which an imposter obtains an individual's SSN and uses it to pose as that individual, typically for the purpose of obtaining credit.[42] The

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that this was the first mass marketing of that kind of information." *Id.* at 2. At present, the P-TRAK file does not display social security numbers to the individual accessing the file. However, searches still may be conducted by social security number. Thom Weidlich, *Private Domain: Democrats and Republicans Agree on a Least One Thing – The Need for Privacy Legislation*, DIRECT, Apr. 1997, at 1, *available in* LEXIS, News Library, Curnws File.

41. *See* Stacey Singer, *Finding Info in Computer Age is Easy; Finding Privacy is Harder*, ORLANDO SUN-SENTINEL (Aug. 3, 1997) <http:www.sun-sentinel.com/news/3808.htm> (discussing the dissemination of personal information, including social security numbers, by private firms that track consumers).

42. Greidinger v. Davis, 988 F.2d 1344, 1352-54 (4th Cir. 1993) (recognizing the serious consequences of widespread availability of Social Security numbers).

> Since the passage of the Privacy Act, an individual's concern over SSN's confidentiality and misuse has become significantly more compelling. For example, armed with one's SSN, an unscrupulous individual could obtain a person's welfare benefits or Social Security benefits, order new checks at a new address on that person's checking account, obtain credit cards, or even obtain the person's paycheck. Elizabeth Neuffer, *Victims Urge Crackdown on Identity Theft*, BOSTON GLOBE, July 9, 1991, at 13, 20 (stating that Massachusetts, "[a]uthorities say that, with another person's Social Security number, a thief can obtain that person's welfare benefits, Social Security benefits, credit cards or even the victim's paycheck."); Michael Quint, *Bank Robbers' Latest Weapon: Social Security Numbers*, N.Y. TIMES, Sept. 27, 1992, at 7 (stating that SSN can be used to order new checks at a new address). In California, reported cases of fraud involving the use of SSNs have increased from 390 cases in 1988 to over 800 in 1991. Y. Anwar, *Thieves Hit Social Security Numbers*, SAN FRANCISCO CHRON., Aug. 30, 1991, at A1, A2. Succinctly stated, the harm that can be inflicted from the disclosure of a SSN to an unscrupulous individual is alarming and potentially financially ruinous. These are just examples, and our review is by no means exhaustive; we highlight a few to elucidate the egregiousness of the harm.

Greidinger, 988 F.2d at 1353-54. *See also* State *ex rel.* Beacon Journal Publ'g Co. v. Akron, 640 N.E.2d 164, 169 (Ohio 1994) (holding that employee's Social Security numbers were records but disclosure of those records would violate rights to privacy). In holding for the plaintiffs, the court recited the following illustration of the risks of such disclosure:

> In this case, James E. Young, an employee of the city, testified that he objected to the city's release of his SSN because of the harm

losses from such fraudulent borrowing ultimately fall on the creditors, although only after the individuals being impersonated go to extreme and inconvenient lengths to establish that they are not responsible for the debts incurred.[43] It is likely that most credit providers will, at some point, simply quit requiring SSNs and insist on a more reliable means of identification from applicants. As digital signatures become more widely understood and available, and as their cost falls to a nominal level, they are likely to become the standard form of identity authentication for credit applicants. Hence, in a relatively few years, it is likely that virtually every American adult will have a digital ID.

A good deal of infrastructure must be put into place before widespread use of digital IDs can occur. Most states now have enacted some legislation dealing with digital IDs, but the statutes vary enormously, and most are very rudimentary. The Utah and Washington statutes are the most comprehensive;[44] they adopt PKI as the "official" form of digital signature, provide for approval and regulation of CAs, and purport to allocate the risks of various errors that may occur in a PKI system. Most of the other statutes, however, simply approve the use of digital signatures in situations in which conventional signatures would otherwise be necessary; they do not adopt any specific form of digital signature, and do not provide for state licensing of CAs.[45] Even in the few states

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previously caused by the unwarranted release of his SSN. Young testified that, in 1989, he and a friend were attempting to purchase a rental property. Young was informed that he would be denied credit partly because of delinquent accounts with retail credit institutions.

Young was notified by the ex-wife of another James E. Young ("Young 2"), that Young 2 had obtained Young's SSN when Young 2 requested his own transcript from the University of Akron. The university erroneously sent Young 2 the transcript of Young, complete with Young's SSN. Young 2, using the improper SSN, opened accounts with Firestone, Texaco, Associate Finance and a department store in Richmond, Virginia. Apparently, Young 2 had used these accounts and was delinquent in paying them. In order to rectify his credit record, Young had to pay nearly $800 in attorney fees. The plight of Young illustrates the ability of a pretender using an SSN to assume another's identity. This is perhaps the ultimate invasion of one's privacy.

Id.

43. *See* Michael Higgins, *Identity Thieves*, A.B.A. J., Oct. 1998, at 42, 47; Stacey Singer, *Identity Theft Becoming "as Ubiquitous as Pickpicketing"*, ORLANDO SUN-SENTINEL (Aug. 31, 1997) <http://www.sun-sentinel.com/news/08280014.htm>.

44. Utah Digital Signature Act, UTAH CODE ANN. §§ 46-3-101 to 46-3-504 (1998); Washington Electronic Authentication Act, WASH. REV. CODE ANN. §§ 19.34.010 to 19.34.903 (West 1998).

45. Anthony Martin Singer, *Electronic Commerce: Digital Signatures and the Rule of the Kansas Digital Signature Act*, 37 WASHBURN L.J. 725, 736 nn. 88-89 (1998). The California statute, for example, defines a digital signature merely as an "electronic identifier" and does not specifically require use of PKI or any other protocol. CAL. GOV'T CODE ANN. § 16.5 (West 1998).

providing for licensing of CAs, few CAs have actually been approved.[46] In other states, there is a significant risk that irresponsible CAs might enter the digital signature business but fail to use adequate security precautions, with the result that their data bases might be invaded or that digital IDs might be issued to imposters.

There are several concerns with respect to the reliability of digital signatures based on the PKI model. One concern grows out of the fact that a subscriber's private key must be stored on some medium so that the subscriber can use it as needed. From a technical viewpoint, there are many choices of media: the private key may be held on the user's hard drive, a floppy diskette, or a hardware-based "smart card."[47] But all of these forms of storage are problematic. A hard drive may be read or modified by a clever thief if its host computer is connected to a network or if the thief simply gains direct access to the computer keyboard. A floppy diskette is obviously even easier to read or modify, since it is accessible in any computer into which it is inserted. A smart card may be lost by or stolen from its owner. Of course, various passwords and similar security precautions may be used with all of these media, but any password that is brief enough for its legitimate user to remember (say, four to eight characters) is also relatively easy for a determined hacker to break. Firewalls (which protect the local hard drive from access by other persons on the same network), virus detection programs, and other techniques will help, but none is foolproof.[48]

While smart cards seem more secure than magnetic disks, they have their own set of problems. Individuals are responsible for the security of their own private keys. If one's key is stored on a smart card, a thief who simply steals the card and who can break the "PIN" or password can effectively forge the user's digital signature. The same could result from the user's handing over the card to someone who is believed to be trustworthy, but who in fact is not. The potential for loss from such a theft or improper use, if

46. *Utah Becomes First State to Provide For Digital Signatures*, 15 COMPUTER LAW 26 (Jan. 26, 1998). Utah, which enacted the first digital signature statute, also became the first state to license a certification authority. *Id.* Digital Signature Trust Co., a subsidiary of Zions First National Bank, was licensed by Utah on November 18, 1997. *Id.*

47. R. R. Jueneman and R. J. Robertson, Jr., *Biometrics and Digital Signatures in Electronic Commerce*, 38 JURIMETRICS J. 427, 443-45 (1998). A "smart card" is typically the same size as a credit card, but has embedded in it a memory chip that holds the relevant data—in this case, the user's private key. The chip cannot be erased or modified, and does not depend on battery power to retain its memory. Hence, the smart card, when placed in a suitable reader, will always supply the user's private key in precisely the form that was embedded in the chip when the card was fabricated. *Id.*

48. *Id.* at 443.

legally allocated to the card's owner, is enormous.[49] Hence, many individuals may not want the responsibility of keeping their own private keys. It seems likely that, as digital IDs become more commonly used, several "tiers" of smart cards may be produced. The lower-tiered cards, which will authorize only transactions of a relatively small dollar value (e.g., $5,000 or less) might be routinely carried by their owners. Higher-tiered cards, which would authorize transactions without dollar limit (including real estate transactions) might be considered too risky to carry on one's person. Instead, they might be held "in escrow" or "in trust" by banks, title companies, or other entities when not being actively used.

C. Alternatives and Adjuncts to PKI

In recent years, there has been a major advance in the techniques of biometric identification. The term "biometric" simply means the measurement of some biological characteristics of an individual. A biometric measurement is typically output from the measuring device as a stream of characters, termed a "biometric token," that uniquely represents the result of the measurement. If a token is obtained in connection with a particular transaction, and is compared with a database of preexisting tokens of known individuals that includes the person just measured, it becomes possible to identify him or her as a specific individual in the database.

Many types of biometric measurements are possible. Currently available technology includes measurements based on handwriting,[50] fingerprints,[51] facial characteristics, voice, and the iris of the eye.[52] All of them share the characteristic that it is virtually impossible for an imposter to duplicate them. However, no biometric is worth anything unless there is a reference database with which to compare it. For purposes of corporate security, this is not a major barrier, since a company can require all of its employees to submit to measurement as a condition of employment, and can record their biometric measurements on a

49. *Id.* at 444-45. A further risk exists that if a smart card were placed in a reader owned by an unscrupulous merchant, the merchant's computer might surreptitiously copy both the encrypted private key and the password from the card, enabling the merchant to make unauthorized use of it later. *Id.* at 444.

50. *See* Jueneman & Robertson, *supra* note 47, at 448-51.

51. Ron White, *Fingerprint Biometrics*, PC COMPUTING, Sept. 1998, at 256. A firm called DigitalPersona currently manufactures and sells and complete computerized fingerprint identification system, using a simple reader that connects to the universal serial bus port on a personal computer. *See DigitalPersona*, (visited Jan. 21, 1999) <http://www.digitalpersona.com/body_index.html>. The system is intended primarily for corporate internal security applications. *Id.*

52. *See* Don Steinberg, *Do I Know You?*, PC COMPUTING, Oct. 1998, at 14.

secure file server for later reference.

Can biometric measurements be used on a wider scale to identify members of the general public? It is conceivable that this could occur if all participating members of the public first submitted to measurement and recording of their biometric tokens in a publicly-accessible database. No such databases exist at present. For example, the FBI's fingerprint files include many categories of individuals, such as lawyers and convicted felons, but they are very far from including all adult Americans. Civil libertarians are likely to view any proposal for widespread government-sponsored biometric measurement as threatening and objectionable. I do not agree with that assessment; indeed, I think it would a very desirable advance over the present practice of using SSNs as authenticators of identity. But I would surmise that implementation of such a program of governmentally-sponsored biometrics would be politically difficult.

On the other hand, one can easily envision the use of biometrics as an adjunct to PKI. If each person who applies for a digital ID in a PKI environment also submits to biometric measurement, the public key assigned to each applicant can include his or her biometric token. When that individual "signs" a document using the assigned digital ID, he or she would also be asked to submit to a biometric measurement, the result of which would be encoded with the signature. The document's recipient would then use the person's public key to decode not only the signature, but to authenticate the biometric token as well. Such a system would be slightly more cumbersome than the use of PKI signatures alone, but it would virtually eliminate the risk that the signature was being given by an imposter who had stolen or hacked the owner's smart card or other media.

Biometrics is not yet a mature technology, but it has advanced rapidly in recent years. Many issues remain. Of the various types of biometrics—handwriting, fingerprinting, and so on—which is the most practical, cheap, and reliable? How costly and difficult to use are the various types of hardware readers that make biometric measurements? If the business world widely adopts biometrics as authenticators of identity, it might be efficient to avoid competing use of several different types of biometric devices. Finally, if biometrics are as good as their proponents claim, is the use of PKI really necessary? Or might biometric measurement, by itself, be a sufficiently reliable form of identification?

At this point, any legislation or regulations considered for adoption ought not to foreclose the technological options. PKI is an attractive technology in many respects, but it is clearly only one of several approaches to secure and reliable digital signatures. New forms of biometrics, not yet available, may prove to be

superior to any now in use.[53] It is critical that dogmatic legislation not place the technology in a strait jacket.

D. The Dilemma of Initial Identification and the Role of the Notary

All forms of digital signature technology depend on the creation of a data base that binds together an individual's name and some digital token (a private key, a biometric measurement, or both) that is unique to that individual. Hence, all of these forms face a common dilemma: when an individual seeks initial admission to the system, how can the CA be certain of the applicant's identity? In a corporate PKI structure, this may be only a minor issue, since the corporation will be dealing only with its own employees, and it is presumably satisfied as to their identity. The problem assumes major importance in real estate transactions, where most conveyances are to persons with whom the grantor has no prior acquaintance or common organizational affiliation. The dilemma arises because there is no universal data base to which the CA can resort to authenticate the applicant's identity. The initial authentication is of critical importance, since a mistake at that juncture may allow an imposter to perpetrate a large number of fraudulent transactions. Moreover, if an imposter secures initial registration, no conceivable degree of subsequent security or authentication will do any good. Thus, a very high degree of care should be expected of CAs in registering people who will use their digital IDs in real estate conveyancing.

The policies followed by VeriSign, currently one of the largest certification authorities, illustrate this point.[54] VeriSign offers two classes of digital IDs. The Class I ID is designed primarily to authenticate the subscriber's e-mails, not his or her identity, and is available free for a sixty-day trial period or for $9.95 per year. Registering requires merely that the applicant submit his or her name and e-mail address. Hence, it is easy for an imposter to register under someone else's name, and a Class I ID has little value in authenticating its user's identity.[55] On the other hand, a

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53. *See* Ingrid Wickelgren, *Gene Readers*, POPULAR SCI., Nov. 1, 1998, 56-57 (indicating that it is possible that in the future a simple and inexpensive device may be able to read an individual's DNA and convert it into a digital token). *Id.* at 57.

54. *See Digital ID Center* (visited Jan. 17, 1999) <http://www.verisign.com/client/enrollment/index.html>.

55. *Id.* One critic analyzed the Class 1 ID as follows:

> One claim made by VeriSign regarding digital IDs is: A Class 1 Digital ID provides you with an unambiguous name and e-mail address. BZZZT. Wrong answer. I could understand this claim if they made some effort to establish identity or use confirmation via email like the New York Times. Even then they would be vulnerable to other impersonation attacks, which raises a question about the value of such IDs.

Class I ID is not expected to be used for financial transactions, so little if any financial loss is likely to result from an impersonation.[56] A class II ID costs $19.95 per year. It is intended to authenticate the subscriber's identity, and VeriSign requires significantly more identifying information about applicants: name, present and immediate past addresses, birth date, SSN, driver's license number, home telephone number, spouse's name, employer, and a "challenge phrase" which is required to revoke, replace, renew or set preferences for the digital ID.[57] The precise extent of VeriSign's checking of these items of information before issuing the ID is unclear, but demanding this much personal information is obviously a considerable protection against a fraudulent applicant. On the other hand, a determined "identity thief" could certainly obtain and submit all of the required information about his or her victim with relatively little effort. Obviously a CA's procedures to verify applicant's identities could be considerably more extensive than those used by VeriSign for its Class II IDs. For example, the applicant might be required to submit, in person, a driver's license or other photo ID, a birth certificate, a Social Security card, and any number of other identifying documents.

The traditional method of authenticating the identity of signatories of real estate documents is the certificate of a notary public. A certificate of notarial acknowledgment is required in order for a document to be recorded in most states. In theory, the signer must be "known to" to the notary, so that she or he can certify that the known individual has adopted the signature as his or her own. In reality, of course, the notary is rarely personally acquainted with the signer, and instead relies on the word of a real estate agent, title or escrow officer, or lawyer as to the signer's identity. If the signer is a forger, these individuals may also be deceived, or may be in cahoots with the forger. The notary may or may not demand any other evidence of the signer's identity, and if such a demand is made, it will probably be minimal—for example, one "picture ID." For these reasons, a notary's certificate provides little real protection against forgeries.[58]

It is debatable whether notaries *per se* should have any role at all in a system of real estate transfers that employs digital

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DigiCrime, (visited Feb. 7, 1999) <http://www.digicrime.com/id.html>.

56. *See Digital Id Center, supra* note 54 (noting that VeriSign provides an insurance contract of $1,000 against economic loss caused by "corruption, loss, or misuse of [the] digital ID").

57. *See Verisign Enrollment* (visited Jan. 17, 1999) <http://digitalid.verisign.com/client/class2MS.htm>.

58. See Michael L. Closen & R. Jason Richards, *Notaries Public—Lost in Cyberspace, or Key Business Professionals of the Future?*, 15 J. MARSHALL J. COMPUTER & INFO. L. 703, 713 (1997) for the well-documented but miserable record of notaries as detectors of forgery.

signatures. What is clear, however, is that CAs must be required by law to use extensive and thorough identifying measures when issuing original digital IDs—thus, in effect, assuming the role of notaries. VeriSign's Class II ID processes, described above, are minimal (and quite arguably insufficient) for real estate signatures, in light of the enormous consequences of impersonation. Whether a notary public is used to enforce the identifying measures is less important than that they be performed consistently and thoroughly. If the digital signature is based on a PKI structure alone, without biometric augmentation, it is probably desirable to continue to insist on notarial acknowledgment of the individual's signature at the time of signing; doing so provides at least a little protection against the possible theft or hacking of private keys. However, if the digital signature is augmented by use of a biometric token, use of the notary is arguably unnecessary, since the biometric process is likely to afford far sounder protection against forgery than the notary would provide. On the other hand, continued use of notaries at the time of signing may be justified because notaries, whatever their inadequacies in authenticating identity, can verify that the signer is alive, conscious, apparently competent, and not acting under visible duress.

The problem of initial identification of applicants for digital IDs cannot be solved in an ultimate sense. Unless we envision a society in which every baby born is immediately subjected to a biometric measurement (based, say, on the baby's DNA) and placed into a national data base, there is no absolutely certain way of ensuring against impersonation and forgery. The use of digital signatures can greatly reduce the risk of fraudulent conduct, but it cannot eliminate it completely. This fact provides no cause to reject or delay the implementation of digital signatures. Title insurance has absorbed the risk of forgery for many decades, and no doubt can continue to do so (with considerably fewer losses) in a digital signature regime.

E. Requiring Grantee's Signatures

Modern American real estate practice does not require or expect grantees to sign deeds and other conveyances. It is usually assumed that the grantee's signature is unnecessary, and adds little of value.[59] It is the grantor's signature that is critically important.

59. ROGER A. CUNNINGHAM ET AL., LAW OF PROPERTY § 11.3, at 786 (2d ed. 1993). Acceptance of a deed by its grantee is presumed if the grant would benefit the grantee, as is usually the case. *Id.* However, a question occasionally arises as to whether a grantee has accepted a deed. *Id.* The presence of the grantee's signature would be helpful, and perhaps dispositive, in resolving the question of acceptance. *Id.* at 786 nn. 29-31.

However, in a digital recording system, there might be a great deal of sense in requiring grantees to sign conveyances. The reason is that such signatures could be of considerable help in establishing a reliable chain of title. Consider the case of a deed from A to B, recorded in 1960. Subsequently, a deed from B to C is recorded in 1980. A title examiner today is faced with the question whether "B" as grantee in the 1960 deed and "B" as grantor in the 1980 are in fact the same. If the names are identical, the examiner can do little more than assume that they are the same person. But if B signed the 1960 deed as a grantee, and if B's signatures both as grantee and grantor had been digital signatures, it would be easy for the examiner to compare the two deeds and determine if the signatures were identical. This would be feasible because, unlike pen-and-ink signatures, digital signatures can be compared with absolute accuracy.

This feature of digital signatures could be especially useful when individuals change names or when someone with a very common name signs a deed. Is "John Smith," grantee in Deed No. 1, the same "John Smith" who signed Deed No. 2 as grantor? Is "Mary Jones," grantee in Deed No. 1, the same person as "Mary Smith," grantor in Deed No. 2? A comparison of the digital signatures could put these questions to rest almost instantly. Similarly, when a corporation or other business entity is acquired by or merged into another entity, the Certification Authority could be authorized to make a transfer of the first entity's digital ID to the second entity, permitting it to continue to use the old signature. Thus, questions of entity succession raised by title examiners could be resolved almost automatically by comparing signatures.

It is doubtful that requiring grantees' signatures as a matter of law would impose significant hardships. In nearly all modern real estate transactions, the purchaser is expected to sign a wide range of disclosures, affidavits, and other forms. Signing the deed itself would be a minor change. Requiring such signatures should be seriously considered.

V. POLITICAL AND ADMINISTRATIVE ISSUES RAISED BY TECHNOLOGICAL CHANGE

Even when change offers theoretical efficiencies, it is not always embraced warmly by those affected by it. The sort of digital recording system I have described in this article is likely to be seen as threatening and problematic by some recorders, and perhaps by others in the real estate industry as well. In this section, I attempt to identify the principal arguments that might be made, on the basis of political and administrative factors, against the conversion to a digital recording system.

A. Reduction of Political Patronage

In the short run, development of the software for a comprehensive digital recording system is likely to be quite costly. No off-the-shelf software products now exist that could do the job without a great deal of manual customization. On the other hand, once the system is created and working smoothly, recorders who use it can expect to experience major reductions in number of office employees. The reason is that digital recording can be expected to eliminate a very large portion of the hand processing that now takes place in recorders' offices.

From a recorder's viewpoint, this sort of reduction in personnel is not necessarily desirable. If the recorder is elected, reducing personnel and increasing efficiency may be useful arguments in a campaign for reelection. However, for many recorders, the power to supervise a large staff is probably one of the key perquisites of the position. Laying off staff may be seen as tantamount to reducing one's authority and centrality in county government. Recorders may attempt to offset the reduction by seeking and acquiring new duties and responsibilities, thus keeping their staffs busy despite the reduced demands of real estate recording. But it is not hard to imagine that some recorders will oppose automation simply because they expect it to cut their patronage potential.

B. Statewide recording

Existing real estate recording systems are organized at the county level in most states. In a few states, some individual cities have their own recording systems,[60] and in a few others, recording is routinely handled on a town or city basis.[61] But if digital recording were implemented along the lines discussed in this article, there would be no persuasive reason to operate local recording systems at all. Instead, a single unified statewide system could serve the entire jurisdiction. Since documents would be submitted electronically and searches would be made electronically, there would be no particular benefit to the public in having a recorder's office nearby.

Statewide administration has a number of advantages. It would ensure that a single approach to title searches would operate throughout the state, so that searchers would be able to work in the records of any county or group of counties without retraining. The quirks and idiosyncrasies of individual county

60. See MO. REV. STAT. §§ 59.220, 59.313 (1998) for example where the City of St. Louis, Missouri is not a part of any county and has its own Recorder of Deeds.

61. See VT. CONST. art. II, § 62 and 24 VT. STAT. ANN. § 1154 (1997) where recording is handled by town clerks in Vermont.

records, so commonly found today as a consequence of local conditions and political factors, would disappear. Statewide administration would make it easier to hire highly competent people to manage the system, a goal that could be quite hard to achieve in some individual counties, particularly those with small budgets and limited management sophistication.

However, statewide recording might be viewed with unalloyed horror by some existing county recorders. Their opportunities for political patronage would be not merely reduced, but eliminated, along with their own jobs. Resistance to such a change could be very substantial.

C. Collection of Fees and Taxes

Today recording fees are usually paid by check and submitted with the document to be recorded. In a digital recording system, however, no paper documents would be transmitted to the recorder, and mailing in a separate check to correspond with each recorded document would be very inconvenient. Recorders would instead need to adopt electronic payment systems. They might, for example, simply accept credit card payments like many merchants who do business on the Internet. Another approach would be to permit lawyers, title companies, escrow companies, and others who engage in significant volumes of recordation to set up accounts with the recorder, make initial deposits, and then draw upon them to cover recordings, replenishing the account as needed.[62]

A number of states impose taxes on real estate transfers. If the county recorder is the usual collector of such taxes, they can be paid in the same manner as filing fees.[63] However, in at least a few states, local city or town governments may impose local-option transfer taxes. A Chicago lawyer once described to the author a closing of a real estate sale in a suburban city in Cook County, Illinois. It was necessary to hand-carry the deed to the city hall to have the city's revenue stamps affixed, and then to deliver the deed to the recorder's office in downtown Chicago for recording. This sort of bureaucratic nonsense is reminiscent of the former Soviet Union. To achieve the efficiencies of which a digital

62. This approach has also been suggested for payment of filing fees in computerized litigation filing systems, several of which are currently under development. See James E. McMillan, *Electronic Court Document Filing* 11-14 (1998), a paper presented on August 2, 1998 at the American Bar Association meeting in Toronto in which McMillan identifies five potential methods of fee payment: electronic fund transfer, escrow accounts, credit and debit cards, direct billing, and (in the future) digital cash.

63. *See, e.g.*, 35 ILCS § 200/31-15 (1998) (authorizing the county recorder of titles to collect the transfer tax and specifying the nature of the stamps to be affixed to a deed when the tax has been paid).

recording system is capable, it will be necessary to consolidate the collection of transfer taxes in the recorder's office, whether its jurisdiction is county-wide or state-wide.

D. Security Concerns

Computer records, like paper records, are subject to the risk of damage or destruction. Many computer users, especially in moments of frustration, regard computer hard drive files as particularly volatile and unreliable. It is well to remember that public real estate records have been destroyed in many courthouses throughout the United States as a result fire and other casualties. Perhaps the most famous was the great Chicago fire, which left Cook County with no public real estate records.[64] The problem of data back-up is not unique to computerized records; every responsible public recorder, whether using paper or computer storage, must be concerned about security from loss of data.

It is true that computerized records have the potential for loss by means of a new set of catastrophes—software "bugs," hard disk crashes, and other hardware faults—to which paper records are not subject. On the other hand, it is far easier and cheaper to "back up" (that is, to make a duplicate copy for security purposes) a computer data base than a similarly-sized set of paper records. Traditionally, backups have been made on a daily or weekly basis, and the resulting media (usually in the form of magnetic tapes) have been stored off-site. However, products now exist that will permit backups to be made on a virtually instantaneous basis to a remote location, so that a transaction recorded in New York can be backed up to a computer in California within milliseconds.[65] In addition, the remotely backed-up data can be accessed for normal use almost immediately if the local copy of the data base becomes inaccessible because of a disk crash.[66]

Of less critical importance, but still highly desirable, are measures to keep the local system running and accessible at all times. This means using redundant hardware in the recorder's office,[67] and employing uninterruptible power supplies so that a

64. *See* Christi Parsons, *Historian Finds a New Suspect for Chicago Fire*, CHI. TRIB., Jan. 7, 1997, at 1. Fortunately, Chicago Title Insurance Co. had quite complete records that survived the fire. *Id.* This event is said to have given Chicago Title Insurance Co. an enormous boost in clientele.

65. One such product is Off-SiteServer, produced by Miralink, Inc., of Salt Lake City. Mirroring can be done over ordinary twisted-pair telephone lines up to 5,000 feet from the local server, and can be done at any remote site using ordinary communications circuits with speeds as low as 56K bps. *See* Miralink Corporation, *Products—Off Site Server V.35™* (visited Jan. 16, 1999) <http://www.Miralink.com/server.htm>.

66. *See id.*

67. See Holly Holland & Andrew Wolfson, *Glitch in County Clerk's*

temporary loss of electrical power will not close the system down. In addition, the system must be protected against software hackers and viruses. Of course, methods for accomplishing these objectives are well understood in the business computer field; indeed, the United States economy could hardly function without them. Recorders must adopt the best security features used by businesses if they are to provide reliable and consistent service to the public.

A recorder's system must also be kept up to date. Magnetic media do not last forever, so backups must be made to fresh media, and perhaps to optical disks as well, since the latter have much greater stability and longevity than magnetic disks.[68] Conversions of data must be made as old file formats (e.g., Word or WordPerfect) become obsolete and new formats are introduced.

Implementing these security concepts is a technical task requiring considerable expertise. It is likely that recorders in larger, more populous counties with computer support staffs could handle them well. Whether recorders in small counties with limited staffs could do so is much more doubtful. This concern provides a further argument for statewide implementation of digital recording.

E. Other Political Issues

The full-scale digital recording system outlined in this article will require the cooperation of many people. Agreement on a standard set of real estate forms may require input from the state attorney general, the state bar, the title insurance industry, and the state real estate commission, as well as the recorders themselves. Producing a set of digitized maps of the county or the state is a costly undertaking and will require significant appropriations, and more money will be needed to maintain those maps as land subdivisions and consolidations occur. Title insurance companies and lawyers will need to be satisfied that a new recording system will meet their needs and will not leave them at risk in their relationships with clients and customers.

Computer Stalls Buying, Selling of Real Estate, COURIER-JOURNAL (Louisville, Ky.), Apr. 25, 1992, at 1A, *available in* 1992 WL 7832579, for examples of breakdown in processing as a result of failure to provide adequate hardware redundancy. *See also* Donna R. Engle, *Computer Crash Halts Land Office*, BALTIMORE SUN, Aug. 17, 1995, at 1B, *available in* 1995 WL 2459242 , (indicating that a common redundancy technique is the use of RAID "redundant array of independent drives" hard disks, so that the failure of one disk will have no effect on operations); Rising Edge Technologies, *The Basics of RAID Technology* (visited Jan. 16, 1999 or last modified Feb. 23, 1998) <http://www.rising-edge.com/industry/overview/raid/index.htm> (explaning RAID).

68. *See* Kenneth R. Rohr, *Image Storage Media—Optical and Magnetic*, 11 IMAGING SERV. BUREAU NEWS (Sept.-Oct. 1997) (illustrating that optical disks are more stable than magnetic disks).

Regulation of certification authorities (CAs) is also potentially controversial. If the CA is to fulfill the role of notary, it will be necessary to establish standards that CAs must meet in verifying identities of applicants, in maintain security for their own records, and in providing ready accessibility of public keys. Obtaining consensus on all of these issues will probably require, in a given state, the leadership of some individual who commands respect and possesses a great deal of political acumen.[69]

VI. THE NEED FOR UNIFORM LEGISLATION

Most of the elements of a digital recording system, as proposed in this article, will require implementing legislation. In principle, any state legislature might undertake the task. However, the legal issues are subtle and complex, and few legislators would have the expertise to deal with them competently. It would, therefore, be advantageous for the National Conference of Commissioners on Uniform State Laws to assemble a drafting committee to prepare a uniform digital recording statute.

A. The Uniform Electronic Transactions Act

The Commissioners have a project now in the drafting stage that bears on this proposal in several ways. This project is the Uniform Electronic Transactions Act (UETA);[70] the most current draft is dated September 18, 1998. The core concept of the UETA is that electronic documents should be recognized and enforced to the same extent as paper documents. The UETA specifically excludes wills and codicils, and trusts created in connection with wills and codicils,[71] but there are no other broad exclusions. Thus, the act covers deeds, mortgages, releases, and other ordinary real estate documents. It does not cover "a provision in a rule of law relating to a specific mode of delivery or display of information."[72] While deeds and other real estate conveyances must be delivered to take effect, the general rules of the common law do not provide for any "specific mode of delivery;" hence, this exclusion does not take real estate conveyances out of the act's coverage.

The UETA does not require anyone to use an electronic document, but merely authorizes their use. Similarly, it does not

69. Precisely this seems to be occurring in Iowa, where a respected member of the bar is spearheading a project to implement digital recording. Interview with Professor Arthur Gaudio, Project Consultant, Univ. of Wyo. School of Law (Oct. 10, 1998).

70. UNIFORM ELECTRONIC TRANSACTIONS ACT § 104(a) (Draft for Discussion Only Sept. 18, 1998 available at <http://www.law.upenn.edu/liberty/ulc/uecicta/eta1098.htm>) [hereinafter UETA].

71. *Id.*

72. *Id.* § 104(c).

require any particular mode of delivery or transmission, so long as the recipient of the document has the means reasonably available to retrieve and read it.[73] For example, a grantor could deliver a deed to a grantee simply by e-mailing it to the grantee, provided that the grantee had the means for readily receiving and reading e-mails. Likewise, a deed could be transmitted to the recorder's office for recordation if the recorder was equipped to receive and process e-mail transmissions. The grantee or recorder could, however, expressly provide that it declined to receive e-mailed deeds, in which case some other form of delivery would be necessary.[74]

Under the UETA, the statute of frauds is deemed to be satisfied by electronic documents, whether or not they are printed on paper.[75] Since an electronic document can't be signed conventionally by pen and ink, a signature is defined by the UETA as "an identifying symbol, sound, process, or encryption of a record in whole or in part, executed or adopted by a person."[76] The UETA does not require use of any particular security procedures for signatures, so a grantor who merely appends his or her name to an e-mail conveyance, using ordinary ASCII text, will be deemed to have signed it. Such a signature is as effective as if made by pen and ink.[77] However, the recipient of a document may optionally require that a reasonable security procedure be used in signing it.[78] Thus, a recorder's office presumably could specify that, for purposes of recording, signatures would have to comply with PKI, and perhaps with some biometric procedure as well.

The role of notaries is drastically changed by the UETA. Documents in paper form are required to be notarized in order to be recorded in most states. However, under the UETA, electronic documents need not be notarized, provided that a security procedure is applied to the signature that "establishes by clear and convincing evidence the identity of the person signing."[79] Hence, a digitally encrypted signature based on PKI would almost certainly require no notarization.

B. The Authority of Recorders under the Uniform Electronic Transactions Act

For the most part, current recording statutes make no provision for electronic documents.[80] However, the UETA provides

73. *Id.* § 402(b).
74. *Id.* § 201(c).
75. UETA, *supra* note 70, § 201(b).
76. *Id.* § 102(20).
77. *Id.* § 301(a).
78. *Id.* § 301(c).
79. *Id.* § 304.
80. Changes are already in the wind. *See* 1998 ALA. CODE § 98-476 (1998)

that "[each] governmental agency shall determine if, and the extent to which, it will create and retain electronic records instead of written records."[81] Under this language, any county recorder of deeds could adopt a procedure for accepting and recording electronic documents. Standing alone, this authorization is problematic. Is it really desirable for each of, say, 50 different county recorders in a given state to adopt a unique way of recording digital documents? The competence of many recorders to do this effectively is doubtful, and the result might be chaotic.

It would seem far better to authorize some state official to establish standards for computerized recording systems that all county recorders would be required to follow. Recognizing this, the UETA provides that a "[designated state officer] may adopt regulations setting forth rules, standards, procedures, and policies for the use of electronic records and electronic signatures by governmental agencies."[82] However, this language has proven controversial in the drafting process, particularly because those representing the judicial and legislative arms of state government tend to resist the imposition of standards by a bureaucrat in the executive branch.[83] This is a topic on which further changes are likely before completion of the drafting process; it is not at all clear that the final draft of the UETA will contain either an authorization for governmental agencies to accept electronic documents or a delegation of authority to a state officer to set standards.

VII. CONCLUSION

As applied to recording of real estate title documents, the UETA seems much too general to be effective. This article has identified a wide range of issues that need to be addressed in order to implement a digital recording system. Most of them are simply untouched by the UETA. This is not a criticism, for the UETA was

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(applying only to Barbour County, Ala.). The act provides:

> The judge of probate may provide for the installation and thereafter for the maintenance of an improved recording, archiving, and retrieval system in the probate offices of Barbour County. . . . [R]eal property instruments, personal property instruments, and other documents and records to be recorded, archived, and retrieved with computer-generated files, or to be stored and filed on either optical disk or on paper (as determined by the Barbour County Commission) shall constitute the official record of instruments for the purpose of Section 12-13-43, Code of Alabama 1975.

Id. §§ 3, 4. *See also* CAL. GOV'T CODE § 27279.1 (West 1998) (explaining the applicability of statute to Orange and San Bernadino Counties).

81. UETA, *supra* note 70, § 501.

82. *Id.* § 503.

83. Telephone interview with Professor Patricia Fry, Chair of Drafting Committee on UETA, Stetson Univ. College of Law (Oct. 15, 1988).

not designed primarily to deal with public records, but rather to facilitate private transactions. The UETA's fundamental concepts—that deeds may take electronic form, that electronic documents comply with the statute of frauds, and that secure digital signatures make notarization unnecessary—all of these are desirable and worthy of adoption. But a digital recording system cannot effectively be adopted by a one-line statute that governs all state agencies. There are simply too many additional questions that should be answered by legislation on a statewide basis so that an orderly and consistent conversion path to digital recording can be charted. For that reason, the drafting of a separate uniform act dealing with digital recording is highly desirable.

The UETA's use of a "designated state officer" to impose standards is a concept of critical importance if digital recording is implemented on a county-wide, rather than state-wide basis. Legislation authorizing digital recording will inevitably be somewhat general in nature, simply because too much specificity will tie the system to a state of the digital art, like a fly in amber, that will quickly become obsolete. Someone other than the legislature must be empowered to track changes in the available technology and to apply them consistently to the counties. Rather than using a single "designated state officer" to set standards for all sorts of public digital records, it is probably preferable to designate a specific officer—say, a "state director of real estate recording"—to focus on standards for land recording systems. As a practical matter, that individual should be someone who is experienced both in real estate recording systems and in digital technology.

Conversion to digital recording raises a number of interesting transition issues.[84] How long should the paper records system be maintained, and by whom? Should scanned paper documents be recordable as an interim solution, until a full-scale digital text system can be implemented? How will the costs of software design and hardware execution be funded? To what extent, if at all, should existing documents be scanned retrospectively and added to the digital data base? Should recorders adopt proprietary systems offered by vendors, or should they (individually or as a group) procure the development of a custom system designed specifically for their needs?[85] To what extent should non-title land-

84. *See* Sweat, *supra* note 4, at 17 (describing how the transition process can be difficult and politically volatile).

85. Most existing efforts involve proprietary systems. *See,* e.g., *From Months to Moments: Teranet Sppeds up land registration in Ontario*, *supra* note 10, at 1 (describing the Ontario system). However, there is reason for concern that proprietary systems may lack the flexibility, consistent user interface and interoperability that are desirable in a public land records system. A similar concern has been expressed about electronic filing of

related records (for example, land use, code enforcement, geologic hazard, utility service, law enforcement, and so on) be integrated into a computerized land title records system to create a "cadastre?"[86] All of these issues are beyond the scope of this article, but the drafters of a model statute must consider them.

There is no doubt that the drafting of a uniform digital recording statute will be a challenging and exacting task. What will all of this effort get us? Simply a system that is cheaper, easier to use and administer, more current in its data, and more accurate than our existing recording system. It will not be perfect, for it will carry with it all of the legal flaws and gaps of the present system, and it will not make title insurance unnecessary. But its advantages will be immense. We cannot afford to delay in launching an effort to design it.

litigation documents. Peter A. Santos, a Pittsburgh lawyer involved in such projects, has stated, "One fear I have is that state courts will use systems such as [West or Lexis], and attorneys and the public will become beholden to them for electronically filed documents much as we are for electronic judicial opinions." Wendy R. Liebowitz, *Courts Electrify Suits, Sparks Fly; New Rules Needed for E-filings,* NAT'L LAW J., Sept. 7, 1998, at B6.

86. *See* Onsrud & Reis, *supra* note 27, at 5.