

Under All Is the Net: Surfing the Internet for Real Estate Information

MAURICIO RODRIGUEZ, JOSEPH LIPSCOMB, AND WILLIAM YANCEY

M. J. Neeley School of Business, Texas Christian University, P.O. Box 298530, Fort Worth, Texas 76129

Abstract

Internet use has grown at a remarkable pace over the last several years. The importance of making optimal use of resources available on the Internet (Net) is likely to grow in the future. In this article, we first provide a brief history of the Internet followed by a description of how to access and navigate the Net. We also describe tools for performing useful tasks on the Net. The focus of this article, however, is on real estate resources available on the Internet. This article provides the first comprehensive directory of real estate resources on the Internet. Specifically, we describe four categories of real estate related sites on the Internet: sites that offer real estate for sale, real estate services, academic research on real estate, and research on related topics. In addition to summarizing real estate sites on the Net, we identify questions for future research and provide suggestions for how the Internet can be used to share real estate-related information.

1. What is the Internet?

The Internet (Net) is an international communication system made up of thousands of computer networks supported by private organizations, academic institutions, and government agencies. Using a common communication protocol, over 30 million users in more than 80 countries share information. Estimates for the number of Internet users around the world by the year 2000 are as high as 300 million (Baker, 1995). The Internet is revolutionizing the way people communicate. Through the Internet users can search computer sites all over the world and purchase or sell a variety of goods. The Net may eventually become the major marketplace for numerous goods and services. This growing medium of communication should further increase the interdependence among the world's economies and change the way business is conducted in many industries including those that are related to real estate.

Real estate-related information is being added daily to Internet sites. For example, information about real estate investments is now available on the Internet, as are loan applications and access to consultants. To remain competitive, real estate professionals, whether practitioner or academic, need to know how competitors and colleagues are using the Internet.

The purpose of this article is to provide an introduction to the Internet with a focus on real estate-related resources available on the Internet. The remainder of this section provides a brief history of the Internet and introduces some tools for performing useful tasks on the Net. Section 2 discusses how to connect to the Internet and how to navigate among sites. In the third section, we identify real estate resources currently available on the Net and in the final section offer some suggestions for using the Net to share real estate information.

1.1. Brief history

The precursor of the Internet was initiated in 1969 by the Advanced Research Projects Agency (ARPA), an organization within the U.S. Department of Defense.¹ The initial goal was to have a computer communications network that would be resistant to military attacks by other countries. Given this goal, a set of standards, known as protocols, was established so that messages could be routed among any of the many different computer networks.² Other networks were begun in the late 1970s and early 1980s to serve other research and academic users.³

A communications protocol called Transmission Control Protocol/Internet Protocol (TCP/IP) was an important development. TCP/IP sets standards on how messages are broken into packets and addressed. This standard allows many different computer networks to communicate with each other despite having different internal operating systems.

In 1986, the National Science Foundation (NSF) significantly expanded the Internet by connecting research centers with supercomputers to establish the original backbone of the U.S. segment of the Internet (called NSFNET).⁴ Other countries established their own networks and made links to the U.S. network, making the Internet an international network. Data travels from the backbones to regional networks. The regional networks route data to local servers, which may be large mainframes or small personal computers. The servers route files to the accounts of individual users.⁵

Although much of the initial funding for the Internet came from the U.S. federal government, no one entity owns the Internet today.⁶ Rather, the Internet is a consortium of network administrators that have agreed to common standards for communicating between networks.⁷ The administrators contract with private telecommunication firms, such as Sprint, to maintain the links between the networks.

1.2. Valuable tools

There are four generic tools for accomplishing tasks on the Internet: (1) electronic mail (e-mail) to send messages, (2) Telnet to log on to a remote computer, (3) file transfer protocol (FTP) to transfer files, and (4) tools to locate information sites. Each of these generic tools can be implemented on different hardware platforms and different operating systems, such as DOS, OS/2, Windows, Macintosh, UNIX and so on. These tools exist on most—but not all—networks connected to the Internet.

1.2.1. Electronic mail. Sending and receiving e-mail continues to grow in popularity due to its relatively low cost and high speed. Some e-mail applications allow only the transmission of simple text, while others allow users to send and receive formatted files with formulas, tables, and graphics. The ability to type, send, and receive letters directly into popular word processing software programs combined with easy-to-use menu-driven e-mail software will further motivate more individuals to use e-mail in the future.⁸

Several methods can be used to send e-mail to multiple recipients. For example, users can build personal files for private mailing lists or use a list server. A list server (listserv) is an automated e-mail distribution application that allows subscribers to receive common mail and send e-mail to all addresses on the list.⁹

1.2.2. Telnet. Telnet is an Internet tool that allows users to log on to a remote computer on the Internet. For example, suppose two professors are working together on a research pro-

ject that makes use of a large data set located at one professor's university. Furthermore, assume that during the summer break the professors meet at the university that does not hold the data set. Instead of transporting the large data set and the associated computer programs (which may need adjustments at a new computer facility), the visiting professor could use Telnet to run the programs at his home university.

Telnetting is quite easy to do by issuing the command Telnet and then entering the domain name of the computer site that will be accessed. At this point the user reaches the log on screen that would normally be encountered at the remote computer location. Local networks may require valid user names and passwords to reach some files and applications. Many libraries and government Telnet sites allow remote users to log on without a password.

1.2.3. FTP. File transfer protocol (FTP) is a procedure for transferring files between computers on the Internet. FTP allows a user to log on to a remote computer, scan the remote computer's file directory, receive copies of files and send files from the local to the remote computer.¹⁰ Some FTP sites require users to have validated usernames and passwords to connect. Many public-access sites allow any Internet user to log on with the username "anonymous" and a password equal to the user's e-mail address. FTP differs from Telnet in that FTP does not allow the remote user to run applications.

An advantage of FTP over e-mail is that the entire file is transferred with all its formatting intact. Large data files and programs can be transferred relatively quickly with FTP.¹¹ The files transferred with FTP may contain text, graphics, or application programs. For example, authors and editors can transfer copies of complete working papers including all the embedded formatting for tables and figures. Although some e-mail systems allow users to attach formatted files to messages, other e-mail systems limit the size or type of formatted files that can be attached.

1.2.4. Tools for locating information sites. In the 1980s, researchers sought efficient methods for finding information on sites available through Telnet, FTP, or other protocols. The first Internet search tools allowed users to enter simple text commands and retrieve lists of FTP or Telnet sites that satisfied the users' criteria.¹² While these tools are efficient at retrieving files, they require users to type commands on a keyboard.

In 1989, scientists at CERN, the European Particle Physics Institute, developed the World Wide Web (Web), a revolutionary new system for accessing information on the Internet. The Web is a subset of Internet sites that use hypertext links to make connections between files.¹³ A user connects to a Web page (a file containing hypertext or hypermedia links), moves the cursor over a highlighted text or graphical image, clicks the mouse or cursor control, and links to another location. This new location may be at the same Internet site or may be at a completely different location on the Internet. The files on the Web may contain text, graphics, audio, or video images. This hypertext method of linking is much easier to use because the user does not need to enter text commands.

2. Access

This section provides an overview of how to connect to the Internet and how to navigate once the connection has been made. Numerous books and journals provide detailed instructions and comparisons of alternative methods of accessing the Net (see Abernathy, 1995; Eager, 1995; Ford, 1995; Krol, 1994; Randall, 1995; Waltz, 1995).

2.1. Connecting to the Internet

Connecting a computer network to the Internet requires hardware and leased telecommunications lines that can cost from \$5,000 to over \$100,000 depending on the speed and number of simultaneous users. Individual personal computers or terminals can connect to the network through either a local area network (LAN) or telephone modems. The LAN connection is generally faster and easier to maintain but requires each station on the LAN to be connected by a wire cable.¹⁴ Many universities and research centers have already connected their LANs to the Internet. Telephone modem access might be more limited in transmission speeds but has the advantage that users can dial in from any location.

Several levels of Internet connections are available for users. Shell accounts allow users to perform most functions on the Internet but do not allow access to the graphics files on the Web. To obtain full access to all features, an Internet protocol (IP) address is required.¹⁵

Many commercial providers offer Internet access accounts to individual users at fees ranging from \$10 to \$50 per month. These services require users to use a modem and dial in through a telephone line. The price may depend on the transmission speed, amount of time connected, and level of support services available. Some of the commercial services offer discounts for group subscriptions. Table A1 in the appendix lists some nationwide commercial Internet service providers and their telephone numbers.

2.2. Navigating on the Internet

Many different software applications are available to help users navigate on the Internet. Different versions are available for different computer operating systems, such as DOS, Windows, and Macintosh. Users can install several different applications for e-mail, FTP, Telnet, and Web access or comprehensive packages with many different Internet tools in the same application.

All of these packages use Internet addresses. Addresses for particular files on the Internet consist of a domain name that identifies a particular computer and a path name that specifies the directory and the name of a file. The address for a Web page is a uniform resource locator (URL).¹⁶

Web navigation is done through software known as browsers.¹⁷ Some of the best-known browsers are listed in Panel A of Table A2 in the appendix. The browsers allow the user to connect to a Web page and maintain a temporary list of URLs visited. This allows the user to move forward or backward between URLs without having to retype them. Many browsers allow users to create bookmarks or hot lists with their favorite URLs. Some browsers are free or come bundled with a subscription to a service provider.

To enable users to locate Web pages by topic or title, a number of Web sites have powerful Web search engines. Individuals use a Web browser to connect to a Web page with a search engine and enter keywords and other criteria. The search engine responds with a list of Web sites satisfying the criteria and some information about the sites. The user can scroll through the search results and connect to interesting sites by clicking on a highlighted hypertext link. Panel B of Table A2 in the Appendix lists some popular Web search engines and their URLs.

2.3. Setting up a publicly available site on the Internet

Setting up a publicly available site on the Internet depends on access procedures provided by the administrator of each network. Some networks establish software restrictions to prevent unauthorized users from gaining access to sensitive files and systems. Other networks, particularly at universities, are quite open and allow anyone with a valid user name and password to gain access via FTP or Telnet.¹⁸

3. Real estate resources on the Internet

The number of real estate resources on the Net is growing at a rapid pace.¹⁹ Below we describe real estate resources found on the Internet.²⁰ We divide real estate-associated sites into the following four interrelated general categories: real estate listings, real estate services, academic research on real estate, and academic research on related topics.

3.1. Real Estate Listings on the Net

Numerous Web sites list real estate for sale (Blumenthal, 1996). Potential buyers can search online for real estate offered in their geographic area of interest. Sellers can display their real estate to thousands of potential buyers. Many of these sites list real estate located over a larger geographic area than that typically covered by a local Multiple Listing Service (MLS). Hypermedia makes it possible to display a picture of the property being offered for sale as well as a map identifying the property's location.

These options give rise to important questions for real estate brokers. What are their implications for local MLS systems? Does this mean that local MLS systems, as we currently know them, will become obsolete in the near future?²¹ What new competitors may emerge from this technological revolution? Although some of these sites are maintained by real estate brokers, any individual is free to offer real estate on the Net. Will the role of brokers be diminished or redefined? Many brokers may find themselves doing business across state and national boundaries. Brokers should therefore ensure they are abiding by all applicable regulations concerning licensing requirements.²² There is a large (growing) number of sites on the Net that offer information on property for sale. The focus of these sites range from a small geographic area for residential property to worldwide coverage for various property types. Table 1 provides the URL address for a representative sample of residential and commercial real estate lists on the Net.

Selling real estate on the Internet gives rise to interesting research questions. For example, is it worth the effort to offer property on the Net? Is the Net a good forum for real estate auctions? Benjamin and Chinloy (1995) report that sellers who adopt a technological innovation (a lockbox) benefit in the form of a higher sales price. It would be interesting to examine the economic benefits of selling property on the Internet.

3.2. Real estate services on the Net

Many real estate-related services are offered on the Internet.²³ These service providers include mortgage brokers and other lenders, appraisers, tax advisors, real estate investment consultants, title and other legal services, and real estate software and data vendors.

Table 1. Real estate listing services on the Internet.

NAME	URL ADDRESS	TYPE OF REAL ESTATE
ACONET	http://aconet.com/homes/	Residential in US.
Austin Real Estate Connection	http://www.austare.com/	Provides information on residential and other listings and related real estate services in Texas.
Beir Facts	http://rampages.oncamp.net/~wqbehr/	Commercial real estate in Texas.
Best International Communication	http://os2.lafra.com/bic/index.htm	Residential property in France.
Calgary Real Estate	http://www.chan.com/realty/calgary.html	Commercial and residential property in Calgary and links to lists for various parts of Canada
Darling & Dupens Realty	http://addcon.com/darlings	Residential property in Bermuda.
Flick Resources Center	http://www.fpoint.net/flickr/pictures.html	Commercial.
For Sale by Owner Magazine	http://www.human.com/mt/vishor/	Residential real estate worldwide, geographically organized.
FractalNet Real Estate Server	http://www.fractala.com/realestate.htm	All types of real estate in North America.
Genie's Worldwide Real Estate Forum	http://www.genies.com/genie/maps/RE_usa_index.html	
Global Village Consulting	http://espresso.cable.net/gvcr/realstate/	Most types of real estate in Canada.
Homes & Land	http://www.homes.com/welcome.html	Residential in US, apartment rental information.
HomeWeb	http://www.us-digital.com:8080/homeweb/	Residential property that can be searched by zip code or other characteristics.
InfoSeek: Realtors	http://www2.infoseek.com/Titles?q=Realtors	A list of Realtors resulting from a search on the net.
IREL News	http://www.irel.com/	Contains over 3,000 links to real estate web sites.
National Association of Realtors	http://www.nar.com/	National Association Realtors home page.
Other Real Estate Listing Services	http://www.genie.com/genie/other_re.html	Provides links to many real estate listing services.
Pam Golding Properties	http://os2.lafra.com/pgpl/	Residential property in South Africa.
Property Line	http://www.pinet.com/prop/prop/prop.html	Properties for sale in Europe.
Property Link	http://www.reldirect.com/	Commercial real estate in US.
Real Direct	http://www.intervest.com/re/index.html	Detailed residential information.
Real Estate on-line	http://www.remax.com/	Links to world wide residential and commercial real estate.
RE/MAX International	http://www.realtor.com/tn.htm	One of many Web sites maintained by brokers.
Realtors Information Network	http://www.webads.com/au/	Listing database presented by the National Association of Realtors (NAR).
Web Advertising	http://www.wrenet.com/	Real estate advertisements in Australia.
WRENET	http://www.wrenet.com/	Contains a variety of property worldwide.

The sites for a particular topic may stem from a variety of sources. For example, taxation information sites are provided by a wide variety of government agencies, associations, universities, and accounting firms. Tax sites on the Web are reviewed by Coppins, Schmidt, Spindle, and Yancey (1995).

Several service providers offer useful information as well as a forum for real estate discussions. For example, some appraisers and consultants offer real estate market reports, and several mortgage lenders offer current interest rates online. A real estate discussion forum is provided by the Property Information Group. This group was formed by real estate professionals involved in providing information and research activities related to real property.

Real estate professionals should consider any potential liability that may arise from offering "free" advice through the Internet. It may be wise to communicate appropriate disclaimers instead of being a defendant in a future landmark case.

Table 2 provides the URL address for several real estate-related service providers.²⁴ Panel A of Table 2 provides a list of appraisers and consultants on the Net. Panels B, C, and D provide information regarding mortgage lenders, taxation and legal information, and software vendors, respectively. Finally Panel E provides a list of other sites of potential interest.

3.3. Academic research on Real estate on the Net

Real estate academics should benefit from knowing what real estate resources are available on the Net. Currently, a few research centers and real estate journals provide information on the Internet. Some useful data are also available on the Internet.

3.3.1. Real estate research centers. Research centers can use the Net to let all interested constituents read information highlighting their organization's activities. Examples of these include the Homer Hoyt Center for Land Economics, Texas A & M University's Center for Housing and Urban Development, the Center for Real Estate and Urban Economic Studies at the University of Connecticut, and the Virginia Center for Housing Research. The Net can be used to provide a list of current research papers and an e-mail address to order any papers of interest. The Center for Real Estate and Urban Economics at Berkeley, University of Reading, and the Center for Real Estate at MIT maintain a list of their research papers. The latter even provides abstracts of working papers.²⁵ Panel A of Table 3 provides the URL address for these and other research centers. Other real estate centers should be on the Net soon. Since August 1995, the number of real estate centers with a presence on the Net has more than doubled. Panel A of Table 3 provides the URL address for the centers we found currently on the Net.

3.3.2. Real estate research journals. The *Journal of Real Estate Finance and Economics (JREFE)* site on the Web allows people to examine the table of contents of all previous issues. A full-text search capability on the abstracts to all issues is expected to be available soon. This will allow users to do keyword searches by author, title, or any other words in the abstracts. The site also provides ordering information. *Real Estate Economics* provides these types of search capabilities and also links to the AREUEA home page and other useful real estate-related sites. The American Real Estate Society (ARES) recently established a site that has links to the *Journal of Real Estate Research*, the *Journal of Real Estate Literature*, the *Journal of Real Estate Portfolio Management*, and the *ARES Newsletter* and soon will have a list of its members online. Panel B of Table 3 provides the URL address for these journals.

Table 2. Real estate services on the Internet.

Panel A: Appraisers and consultants		
NAME	URL ADDRESS	TYPE OF SERVICE
Aliceri Associates, Inc.	http://pages.prodigy.com/alicer/	Appraisal.
Appraisal Institute	http://www.realtworks.com/ai/index.htm	Appraisal organization with information about its members.
ARCTOS Group	http://www.arctos.com/arctos/	Consulting on technology and real estate.
Friedman, Billings, Ramsey & Co., Inc.	http://www.fbr.com/fbrfull.htm	Investment banking.
General American Credits	http://www.generacredits.com/	Appraisal & title services.
Hiro & Associates, Inc.	http://www.st.firm.or.jp/~hiroshi/	Appraisal & consulting on Japan's real estate markets.
IRED Appraisers directory	http://www.ired.com/dir/appraise.htm	Directory of appraisers.
J D Appraisal System, Inc.	http://www.viuno.com/mail/jd/	Appraisal & consulting.
Kelley Appraisal	http://montanaweb.com/appraisal/	Appraisal.
Mitsui Fudosan	http://www.anpark.co.jp/enf/english/mitsui.html	Real estate company Web site provides interesting information on conducting real estate activities in Japan.
Realworks Appraiser Forum	http://www.realworks.com/rw/homepage.htm	Provide links to several appraisal firm's home pages.
Sparta Group Information Services	http://indomatch.com/~mlaire/users/edunoes/about.htm	Real estate environmental consultants.
Telares	http://www.arctos.com/arctos/cteres2.html	Consulting on real estate information.
Ten Thirty-One, Inc.	http://www.irc[03].com/031/index.html	Real estate exchange consultants.
Valuation International, Ltd.	http://www.realtworks.com/vil/home.html	International Appraisal and consulting.
Yahoo Real Estate Companies	http://www.yahoo.com/business/corporations/real_estate/	Large list and links to a variety of real estate companies on the Internet.

Table 2. Panel B: Mortgage lenders and mortgage rates

Panel B: Mortgage lenders and mortgage rates		
NAME	URL ADDRESS	TYPE OF SERVICE
CAPEX Capital Exchanges, Inc.	http://www.broker.cube.net/rc.htm	Real estate financing.
Fair Oaks Financial	http://fofs.com/	On-line mortgage agency.
FinanCenter's Home	http://www.financenter.com/newhomes.htm	Mortgage lender.
First Chicago Capital Markets, Inc.	http://fccm.com/interest.html	Investment Banking has on-line interest rate forecast.
Fractal Net	http://www.fractals.com/interest_rates.html	Mortgage rates in S.F. Bay area.
Homebuyer's Fair	http://www.homefair.com/homepage.html	Home mortgage information.
HSH Associates	http://www.hsh.com/rates/web30.html	List of mortgage rates throughout U.S.
J. P. Morgan	http://www.jp.morgan.com/	Financial services provider with links to a variety of information including mortgage indices.
Mortgage Calculator	http://ibc.vnsd1.edu/mort.html	On-line mortgage calculator.
Mortgage Market Information Services, Inc.	http://www.interest.com/mimis.html	Links to mortgage brokers.
Mortgage Rates	http://www.bmo.com/rates/mortgage.htm	Bank of Montreal's current mortgage rates.
Mortgage Rates in Hawaii	http://www.aloha.net/mohall/hbr/rates.html	Mortgage rates in Hawaii for several lenders.
Riverbank Mortgage	http://www.wco.com/~joshb/index.html	Mortgage brokers.
Royal Bank Mortgage Guide	http://www.RoyalBank.com/english/rb/mort.html	Mortgage lender.
Yahoo Mortgage Loans	http://www.yahoo.com/business_and_economy/Real_Estate/Mortgage_Loans/	Links to mortgage brokers.

Table 2, Panel C: Taxation and legal information

NAME	URL ADDRESS	DESCRIPTION
Arent Fox Business Bullets	http://www.arentfox.com/newslett/busbul.htm	Newsletter on current topics in real estate law.
Cornell Legal Information Institute- Land-Use Law	http://www.law.cornell.edu/topics/land_use.html	Legal information from Cornell law school.
Disclosures in Real Estate Transaction	http://www.baynet.com/homebuy/discover.html	Provides information regarding Californian disclosure law.
Electronic Easement - Property Law on the Web	http://www.law.ualberta.ca/ee/	Links to Canadian property law.
Environmental Law	http://www.webcom.com/~staber/	Environmental law information.
Fidelity National Title Information Page	http://www.iahoehomes.com/fidelity.html	Title insurance underwriter.
Income Tax Information in Internet	http://www.best.com/~fmcxpaf/html/taxsites.html	Tax law and tax practitioners.
Planning Commissioners Journal "Takings" Resource Page	http://www.webcom.com/~pcj/takings.html	Property rights information.
Realty-Lawnet	http://www.realty-lawnet.com/	Provides information on many legal issues related to real estate.
Tax and Accounting Sites	http://www.uni.edu/schmidt/bookmark.html	Tax, accounting, and law directory.
TenantNet	http://tenant.net/	Residential tenant's rights information.
Yahoo - Taxes	http://www.yahoo.com/Economy/Taxes	Tax law and practice.

Table 2, Panel D: Information and software vendors

NAME	URL ADDRESS	DESCRIPTION
ACTI	http://www.well.com/user/tenet/acti.html	Property management software from Symantec.
Computermaster, Inc.	http://www.primenet.com/~johaw/ten.htm	Real estate software reviews.
Credit facts of America	http://www.efacts.com/www/vertiz	Real estate information suppliers
RealLinks - Real Estate Software	http://global.iic-net.com/Real-Links/Software/	Links to real estate software vendors.
Schrook & Associates	http://www.reelworks.com:80/schrook/	Commercial real estate information systems consultants.
Site Selection Magazine from Conway Data, Inc.	http://www.conway.com/	Data to corporate real estate and economic development managers.
Z-Law	http://nrmink.com/nrmink/dossiers/zlaw/zlaw.html	Real estate documents software vendor.

Table 2, Panel E: Other sites of potential interest

NAME	URL ADDRESS	DESCRIPTION
American Industrial Real Estate Association	http://www.airez.com/airez.html	Provides information on industrial and commercial real estate brokerage.
American Law and Economics Association	http://www.epias.utoronto.ca:8080/realaw/alea/alea.html	Information related to the Association, including program papers and a list of members.
Consumer Information Center	http://www.gsa.gov/staff/pw/cic/housing.htm	Provides information regarding consumer handbooks on buying and financing homes.
Graduate Realtors Institute	http://www.dnai.com/~realtor/grsigr/gr1.html	Provides information regarding Graduate Realtors Institute (GRI).
Internet Business and Economics	http://www.homefair.com/homefair/busecon.html	On-line articles by Arnold Kling
National Association of Residential Property Managers	http://www.marketnet.com/nrpk/nrpk.asp/	Information on the National Association of Residential Property Managers.
Property Information Group	http://www.reading.ac.uk:80/LM/LM/rij.html	Group that shares real estate related information.
Urban Land Institute	http://www.uli.org/	Describes the Urban Land Institute and contains a variety of real estate related links.
Women in Real Estate	http://www.wia.com/nia/wire/	Organization of women from all areas of the real estate industry.

Table 3. Real estate research on the Internet.

NAME	URL ADDRESS	DESCRIPTION
Arizona State University Real Estate Center	http://www.cob.asu.edu/real/ares/	Describes the Arizona Real Estate Center and its publications.
Center for Real Estate and Urban Economics at Berkeley	http://haas.berkeley.edu/~creue/	Provides a list of current publications of the Center for Real Estate and Urban Economics at Berkeley.
Center for Real Estate and Urban Economic Studies at the University of Connecticut	http://mktg.sba.uconn.edu/real/realst/	Describes staff, resources and calendar of events at the Center for Real Estate and Urban Economic Studies at the University of Connecticut.
Center for Real Estate Studies, Indiana University	http://www.bus.indiana.edu/welcomer/research.html#fores	Provides Center information and its products such as housing affordability reports and RealSource, a real estate bibliographic database.
Homer Hoyt Research Center	http://www.ispa.fsu.edu/hoyt/hoyt.html	Describes the Homer Hoyt Center for Land Economics and Real Estate.
MIT Center for Real Estate	http://web.mit.edu/cre/www/	Describes Center and provides links to abstracts of working papers.
New York University Real Estate Institute	http://www.nyu.edu/courses/real_estate_dep.html	Describes the center at New York University's School of Continuing Education.
Texas A&M University's Center for Housing and Urban Development	http://acs.tamu.edu/~cwarbo/ehud.html	Describes projects this center is involved with and provides links to a few related sites.
Texas A&M University's Real Estate Center	http://recenter.tamu.edu/	Provides news, publications and data on real estate in Texas.
University of Hawaii Real Estate Research and Education Center	http://www.oha.hawaii.edu/real/	Describes the Center activities.
University of Kentucky Center for Real Estate Studies	http://krceres.gws.uky.edu/	Provides information about the center course work and publications.
University of Reading: Department of Land Management and Development	http://www.reading.ac.uk/80/LM/	Provides links to sites for real estate education and research in Europe.
Virginia Center for Housing Research	http://www.arch.vt.edu/vclhr/vclhr.html	General information about the Center and maps and profiles of counties and cities in Virginia.
Washington Center for Real Estate Research	http://www.cbe.wsu.edu/~wrcer/	Offers current publications, summary reports, and lists resources for real estate professionals.
Wisconsin Center for Urban Land Economics Research	http://www.wisc.edu/school/urband.html	Describes the center and its programs and faculty.

Table 3, Panel B: Real estate research journals

ARES related journals	http://www.uneg.edu/~juddon/	The home page for ARES provides links to The Journal of Real Estate Research, The Journal of Real Estate Literature, and the Journal of Real Estate Portfolio Management. This site also provides links to related real estate organizations such as the Pacific-Rim Real Estate Society.
<i>The Journal of Real Estate Finance and Economics</i>	http://www.oba.uga.edu/jrefre.html	Can search information in previous issues as well as forthcoming issues and papers. Also information for prospective subscribers and authors.
<i>Real Estate Economics</i>	http://www.umich.edu/~reeco/index.html	Provides several links to real estate related sites including AREUEA's home page. Also allows for searching this journal's archives.

Table 3, Panel C: Available research data

1990 Census Lookup	http://www.census.gov/cdrom/lookup/	Allow for online searching of census data.
Census Bureau	http://www.census.gov/	Provides links to income, occupation, education and housing characteristics data plus educational materials.
Gopher Menu at Aspen Systems	gopher://aspenstys.aspenstys.com:73/	Provides links to HUD data.
Gopher Menu at Rice	gopher://riseinfo.rice.edu:7011/Subject/Census	Provides links to 1990 census data.
Housing and Household Economic Statistics Division	http://www.census.gov/hhp/pub/files/www	Provides links to housing related data such as vacancies and home ownership.

Table 4. Other sites of interest of the Internet.

Panel A: Economics		
NAME	URL ADDRESS	DESCRIPTION
Agricultural Economics Virtual Library	http://www.ttu.edu:80/~aeov1/	A virtual library with links to numerous agricultural economics topics on the Internet.
Economics Bulletin Board Gopher Menu	gopher://naa.lit.umich.edu/114bb	Gopher menu with links to many economics sites including employment and other statistics.
Information Economy	http://www.sims.berkeley.edu/resources/infoecon	Numerous links to documents on economics and the Internet.
NetEc	http://netec.mcc.ac.uk/NetEc.html	Provides information on working papers, computer code for econometrics applications, and links to economics-related Web sites.

Panel B: Finance		
Educational Resources in Finance	http://www.cob.ohio-state.edu/dept/fm/educ.htm	Provides links to online finance courses, downloadable slides, online textbooks and readings, online financial calculators, and other teaching materials such as online course syllabi.
Finance Virtual Library	http://www.cob.ohio-state.edu/dept/fm/overview.htm	A finance subject page that is part of the World WideWeb Virtual Library. This provides links to numerous finance related sites including some of those cited above.
Financial Economics Network	http://www.ssrn.com/FIN/index.html	Provides abstracts of working papers and accepted papers on a variety of finance and accounting topics. Also provides an electronic placement and press release forum.
FinWeb	http://www.finweb.com/	Provides links to a variety of finance related topics on the Internet.
Research Resources in Finance	http://www.cob.ohio-state.edu/dept/fm/research.htm	Provides links to research centers, research journals, working papers, and home pages of finance faculty on the Web.
StockCenter	http://www.stockcenter.com/	Selected stock data including stock price quotes.
QuoteCom	http://www.quote.com	Provides stock data, both for free and on a subscription basis.

Table 4, Panel C: Geography

NAME	URL ADDRESS	DESCRIPTION
Geography Virtual Library	http://dewey.escl.tenet.edu/migranu/v/geog.html	A virtual library with numerous links to topics related to Geography.
GIS World, Inc.	http://www.gisworld.com/	Introduction to GIS and information regarding GIS conferences and events.
GIS WWW Server Resource List	http://www.geo.ed.ac.uk/home/giswww.html	Provides many links to a variety of GIS sites on the Internet.
Internet Resources for Geography and GIS	http://persau.holycross.edu/PAP/General/Resources-GIS.html	Links to basic collections of resources for GIS and Geography on the Internet, including GIS software and data.
TIGER Digital Map Database	http://www.census.gov/fip/pub/geo/www/tiger/	TIGER map data from the US Census Bureau.

Table 4, Panel D: Statistics

NAME	URL ADDRESS	DESCRIPTION
Penn State Statistics Information Sources	http://www2.ncsu.edu/hcsu/pams/stat/menu.html	Provides links to several statistics sites on the Internet.
SAS Institute	http://www.sas.com/	Provides the latest news and developments at SAS institute.
University of Florida Statistics Library	http://www.stat.ufl.edu/vlib/statistics.html	A statistics virtual library with links to numerous topics related to statistics.

3.3.3 Available research data. Many sites on the Net provide data. FTP can typically be used to transfer data. Some sites even allow for online searches. Some of the more useful sites that provide Census data are provided in Panel C of Table 3. Other useful data are available on the Net; for example, some of the previously discussed sites that list property or offer real estate services provide useful market reports. The sites cited in the next section provide links to economic data, geographic data, and financial data. For example, QuoteCom provides stock prices for real estate investment trusts (REITs) both for free and on a subscription basis.

3.4. Academic research on related topics on the Net

Many other Internet sites of potential interest are available to real estate academics. Table 4 provides sites that we believe may be of interest. We establish subcategories for these other sites as follows: economics, finance, geography, and statistics.

3.4.1. Economics. Numerous sites related to economics are available on the Net.²⁶ The sites listed in Panel A of Table 4 provide an organized outline of some of the sites for economics on the Internet. These sites serve as directories to numerous other sites. Many sites provide macroeconomic and other potentially useful data. These sites are therefore a great place to start.

3.4.2. Finance. Similar to economics, finance has a strong presence on the Net. We provide the address for a well-organized virtual library of finance.²⁷ This provides links to a large number of academic and nonacademic finance resources available on the Internet. Worthy of highlight is the site maintained by the Financial Economics Network. This site provides abstracts of working papers and accepted papers on a variety of finance and accounting topics, as well as some real estate articles such as those forthcoming in *Real Estate Economics*. Other finance sites are listed in Panel B of Table 4.

3.4.3. Geography. Many sites provide geographic information. At the Berkeley site noted below, users can obtain map files that can be used in Geographic Information Systems (GIS). Access to GIS-related data, much of which is available at no charge, should facilitate many GIS applications in real estate analysis. Panel C of Table 4 provides some useful sites that contain geographic information.

3.4.4. Statistics. Given that statistical tools are important to real estate research, we provide a link to a virtual library for statistics. The sites listed in Panel D of Table 4 provide links to files that offer help with programming questions (and programs) in SAS, SPSS, SHAZAM, and other popular statistical packages. Answers to previous frequently asked questions (and some obscure questions) are archived and can be searched with key words.

4. Sharing information through the Internet

One of the major benefits of the Internet is the ability to share information efficiently. We review many real estate resources currently available on the Net. Although there are many real estate-related sites currently on the Net, we did not find a real estate virtual library.²⁸

Real estate professionals, academic or otherwise, will benefit from the establishment of a real estate virtual library. For example, individuals will be able to search for real estate resources organized by topics of interest. Academics can provide links to files that con-

tain syllabi, cases, or other teaching materials that could be shared between colleagues. In other disciplines, journals are already archived on the Internet. Authors may be required to make research data available on the Net.²⁹ Links to working papers, published research, related data, and computer programs can also be established through the Net.³⁰

The burden of maintaining a real estate virtual library can be shared by many people. A major organization's server can be used as a link to major sites broken down by subject area. These sites can be maintained by the top journals, research centers, and companies that can provide further links to relevant people and information. Individuals can then maintain and provide "final links" as they deem appropriate. Note that the links do not have to "end." For example, assume various links led to a particular person and that person provides a link to a working paper. The author could provide further links to work cited in the working paper, leading the reader to a completely new site that has further links.

The virtual libraries cited in the previous section can be used as models for the establishment of a real estate virtual library. Eventually, there will be several real estate virtual libraries. These libraries can be linked to each other and virtual libraries in other disciplines. Although there is bound to be some overlap, it would be most efficient if different real estate virtual libraries are organized with a particular focus in subject categories, geographic areas, or other features.

Real estate markets are often thought of as local in nature, but the Internet has given real estate a truly global forum. Academics have much to learn regarding the implications the Internet's existence has for real estate markets.³¹ Nonacademics must stay informed about the development of real estate markets on the Internet if they wish to reap the potential benefits offered by the Net.

Appendix

Table A1. Nationwide Internet service providers.

PROVIDER	TELEPHONE NUMBER
America Online	(800) 827-6364
CompuServe	(800) 848-8199
Delphi	(800) 695-4005
Microsoft Network	(800) 386-5550
Netcom	(800) 501-8649
Performance Systems (PSI)	(800) 774-3031
Prodigy	(800) 776-3449
UUNET	(800) 488-6383

Note: Some providers in Table 1 offer other services beside Internet access. See Abernathy (1995) and Randall (1995) for reviews of the services. Usually, there are several local service providers in most geographic areas. See Notess (1994) for a more complete listing of Internet access providers.

Table A2. Selected Web access tools.

Panel A: Web browsers

BROWSER	URL ADDRESS
Cello	ftp://ftp.law.cornell.edu/pub/LII/Cello/
Internet in a Box	http://www.spry.com/about/products/index.html
LYNX	ftp://ftp2.cc.ukans.edu/pub/lynx
Microsoft Internet Explorer	http://www.microsoft.com/ie/
NCSA Mosaic	http://www.ncsa.uiuc.edu/SDG/Software/WinMosaic/
Netscape Navigator	http://www.netscape.com/
Quarterdeck Mosaic	http://www.qdeck.com/

Panel B: Some Web search engines

SEARCH ENGINE	URL ADDRESS
Alta Vista	http://altavista.digital.com/
InfoSeek Net Search	http://www2.infoseek.com/
Lycos	http://www.lycos.com/
Netscape Internet Search	http://home.netscape.com/home/internet-search.html
Tradewave Galaxy	http://galaxy.einet.net/search.html
Web Crawler	http://webcrawler.com/
Yahoo Search	http://www.yahoo.com/search.html

Acknowledgments

The authors would like to thank C.F. Sirmans, Austin Jaffe, Grant Thrall, Craig Stanley, two anonymous referees, and Beata Lobert for their helpful comments. If you have any comments please contact the authors via e-mail at the following Internet addresses: m.rodriguez@tcu.edu, j.lipscomb@tcu.edu, and w.yancey@tcu.edu.

Notes

1. For a more complete history of the Internet see Eager (1995), Waltz (1995), and *The Economist* (1995).
2. Information traveling on the network is broken down into small packets that travel independently through various networks and switches until they reach their final destination and are reassembled.

3. Examples of these other networks include MILNET (Military Network), BITNET (Because It's Time Network), NSFNET (National Science Foundation Network), EARN (European Academic Research Network), and Usenet (User Network).
4. Other backbones have been developed in the United States. These include Alnet, PSInet, and SprintLink. NSFNET was funded by the National Science Foundation; the other backbones are run by private entities.
5. Mackie-Mason and Varian (1994) provide the answers to many frequently asked questions about the Internet and also discuss costs associated with maintaining the Internet. If you would like to read more about the Internet, most bookstores offer a variety of books on the subject.
6. Some network administrators recoup the costs of Internet connections by charging fees to each individual user, and others absorb the costs into institutional overhead budgets. Funding will be required to pay for improving information delivery and the quality of information. The enormous growth in demand for Internet services implies resources will be made available to sustain the Net's future development. Sarna and Feibish (1995) and Snyder (1995) discuss future needs related to delivering information on the Internet. Miller (1995) discusses how developing payment methods for quality information will encourage more commercial database publishers to distribute high-quality information on the Internet.
7. The Internet Society in Reston, Virginia, is the international nongovernmental organization that develops standards for coordinating the Internet.
8. An Internet connection allows users to exchange e-mail with users on other networks. The format for an Internet e-mail address is *username@domainname*. The user name is usually an individual's last name combined with other characters or digits. The domain name is the name of a particular computer connected to the Internet. The last two characters of a domain name are the country code. If no country code is specified, the default is the United States. Before the country code are three characters indicating the administrative type. For example, *edu* is for educational or research institutions. Other examples of three-character organization names are *com* for commercial businesses, *gov* for government agencies, *net* for network support organizations, and *org* for other organizations. In many e-mail applications a user can direct e-mail through the Internet by typing *mail username@domainname*. Usually, the Internet address can appear in either upper- or lowercase letters.
9. Electronic news posting systems are another method of sharing text messages with large groups. Whereas an e-mail list sends a message directly to an individual's e-mail box, a posting system requires readers initiate the connection to the posting place, scan the posted messages, and post a new message if desired. Individuals can post questions that may be answered by other people who read the posting. Some posting groups have moderators who keep out irrelevant and offensive items, while others are not moderated. Three different types of electronic posting systems are Usenet newsgroups, electronic bulletin board systems (BBS), and online discussion groups. Usenet is a collection of thousands of topically organized newsgroups set up so that anyone can read the newsgroup's archive, scan past postings, and offer new postings. Local network administrators decide which Usenet newsgroups they will subscribe to and how long they will keep the news articles. Electronic bulletin board systems maintained by hobbyists or companies and on-line discussion groups maintained by commercial services, such as CompuServe or America On Line, are posting systems that may not always be accessible via the Internet. There are many lists such as those described above, including a few that are real estate-related and are accessible through links available at some of the Internet sites that are cited in the third section of this paper.
10. Using FTP is similar to the description provided for using Telnet except the initial command is FTP. However, once one is logged on to the desired site, the user issues FTP commands that instruct the computer to send or receive files. For example, Get can be used to copy a file from a remote computer and Put can be used to copy a file to a remote computer. A list of available commands is often found by typing Help.
11. Because a transferred program may contain a virus, we recommend that an up-to-date virus-scanning program be used before running any downloaded files (especially programs transferred from unknown sources).
12. Examples include Archier, Gopher, Veronica, and Wide Area Information Search (WAIS).
13. The standard language for Web sites is hypertext markup language (HTML). HTML is essentially a formatting procedure that places text on a screen with placeholders for links to other Web sites, data files, or executable programs. You can easily navigate the Web without knowing HTML. Tools for programming in this language are available that allow users to easily establish a home page. A home page is a site on the Web that others can link to and a place you can save your favorite links to other sites. Once a Web page is created, it must be stored on a computer that has an Internet protocol (IP) address and a domain name.
14. Some wireless LANs are being developed where individual personal computers are connected by electronic transmitters with ranges up to 100 yards.
15. An IP address is in the format *n.n.n.n*, where each *n* stands for a four-digit number between 0 and 255. IP addresses are also given aliases in the format *username@domainname*.
16. A URL is in the format: *<method>://<domainname>/<pathname>*. The method is *http* for hypertext Web pages, *ftp* for FTP, *telnet* for Telnet, or *news* for a newsgroup. The domain name in a URL is the name of a particular server. Many networks assign Web servers a domain name that begins *www*.

17. The steps to access an Internet site depend on your local network configuration and the browser software you are using. For example, if you are using a popular browser called Netscape Navigator, you would access the Internet as follows. (1) After Netscape is installed on your computer, double click the Netscape icon. (2) Move the mouse pointer to the entry box labeled *Location*: and type in the URL address of the site you wish to visit. Press Enter. (3) Within about thirty seconds the desired Internet page should be displayed. (4) You can scroll through the page using your mouse or the keyboard and if a phrase is highlighted you may move the cursor to that phrase and double click the mouse (or press Enter) and new page will be displayed. (5) Sites of interest can be stored in bookmark files or returned to by moving forward or backward between previously accessed sites.
18. For more information on publishing information on the Internet, see Ford (1995), Franks (1995), or Lemay (1995).
19. By the time this article is published, some of the address locations may have changed and several new sites are sure to exist.
20. Due to space limitations, we are not able to list *all* real estate sites on the Internet. However, we make an effort to provide a sample from the various real estate-related subjects that we found on the Net. These sites often provide links to related sites.
21. The National Association of Realtors (NAR) recently established the Realtors Information Network (RIN). RIN has two levels of access. The first level allows individuals to access a Web site to overview properties in an area of interest and even look at pictures and read a general description. The second level of access allows individuals with passwords (real estate agents) to access more detailed information regarding listed property. According to NAR, RIN will have a number of listings equivalent to about half the active residential listings nationwide (over 600,000) by early 1996. As of February 8, 1996, RIN had over 108,000 listings online.
22. Perhaps there will be an increase in the number of states that allow automatic reciprocity for licensed real estate agents.
23. *The Economist* (1995) reports that more than 80,000 companies have a presence on the Internet.
24. We do not endorse the particular service providers cited herein, but merely display information regarding real estate services we found on the Internet.
25. In the future, we expect all major research centers to have a presence on the Net, and to provide entire working papers online.
26. Goffe (1994) discusses Internet resources for economists.
27. A virtual library is a gateway on the Internet that provides links organized by subject area.
28. A few sites offer several links to other real estate sites, but these links are relatively limited when compared to those offered by virtual libraries for other subjects such as finance, economics, and statistics.
29. Taubes (1993) discusses electronic archives in physics, and Cinkosky, Fikett, Gilna, and Burks (1991) discuss data submission requirements in molecular biology.
30. Data links can be organized by geographic area, property type, or other criteria of interest in a similar fashion to the previously cited Internet sites offering real estate for sale.
31. Huberman (1988) discusses how computer networks can be thought of as market economies.

References

- Abernathy, Joc. (1995). "The Internet: How to Get There from Here." *PC World* 13(1), 131-146.
- Baker, Molly. (1995). "Stargazers Abound While Internet Stocks Skyrocket." *Wall Street Journal*, December 7, C1-C2.
- Benjamin, John, and Chinloy, Peter. (1995). "Technological Innovation in Real Estate Brokerage." *Journal of Real Estate Research* 10(1), 35-44.
- Blumenthal, Karen. (1996). "Brokers Begin to List Homes on the Internet." *Wall Street Journal*, January 19, B1, B7.
- Cinkosky, Michael J., Fikett, James W., Gilna, Paul, and Burks, Christian. (1991). "Electronic Data Publishing and GenBank." *Science* 252, 1273-1277.
- Coppins, Richard J., Schmidt, Dennis R., Spindle, Roxanne M., and Yancey, William F. (1995). "Worldwide Web: The Latest Tax Resource on the Information Superhighway." *Journal of Taxation* 83(2), 108-118.
- Eager, Bill. (1995). *Using the World Wide Web and Mosaic*. Indianapolis: Que Corporation.
- Economist, The*. (1995). July 1.
- Ford, Andrew. (1995). *Spinning the Web: How to Provide Information on the Internet*. New York: International Thomson.
- Franks, Mike. (1995). *Internet Publishing Handbook*. Reading, MA: Addison-Wesley.
- Goffe, William L. (1994). "Computer Network Resources for Economists." *Journal of Economic Perspectives* 8(3), 97-119.

- Huberman, B. (1988). *The Ecology of Computation*. New York: North-Holland.
- Krol, Ed. (1994). *The Whole Internet User's Guide and Catalog* (2nd ed.). Sebastopol, CA: O'Reilly.
- Lemay, Laura. (1995). *Teach Yourself Web Publishing with HTML in a Week*. Indianapolis: Sams Publishing.
- Mackie-Mason, Jeffrey K., and Varian, Hal R. (1994). "Economic FAQs About the Internet." *Journal of Economic Perspectives* 8(3), 75-96.
- Miller, Michael J. (1995). "The Ubiquitous Network." *PC Magazine* 14(12), 75-76.
- Notess, Greg R. (1994). *Internet Access Providers: An International Resource Directory*. Westport, CT: Mecklermedia.
- Randall, Neil. (1995). "Find It and Do It Online." *PC Computing* 8(3), 112-138.
- Sarna, David E. Y., and Febish, George J. (1995). "Reach for It." *Datamation* 41(16), 27-28.
- Snyder, Joel. (1995). "Paying for the Net." *Internet World* 6(1), 90-91.
- Taubes, Gary. (1993). "Publication by Electronic Mail Takes Physics by Storm." *Science* 259, 1246-1248.
- Waltz, Mitzi. (1995). *The Internet International Directory*. Emeryville, CA: Ziff-Davis.