

Telecommuting: The Workplace of the 90's

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ABSTRACT

The federal government, like industries in the private sector, has the ability to offer its employees flexible work arrangements. One arrangement which is becoming increasingly popular is telecommuting, where employees work for a portion of the week from home or an alternate remote location. As computer awareness, network access, and the World Wide Web are adopted into the mainstream, more and more employees in both the public and private sectors are finding that the tools necessary to successfully telecommute are easily within their reach. Although not every occupation is compatible with telecommuting, SAS® programmers in particular can benefit from a variety of resources which allow remote access to data and programs.

INTRODUCTION

The U.S. General Services Administration (GSA) defines telecommuting as "a means of performing work on a regular basis in a location other than the principal office, either at home or at a nearby telecenter" [1].

Working in an environment outside of the traditional office is certainly not a new concept. In the past 20 years, the number of private sector telecommuters has grown to approximately nine million employees. However, for the federal civilian workforce, telecommuting has traditionally been underutilized, mostly due to management and policy related issues.

On July 11, 1994 and June 21, 1996, President Clinton issued two memoranda directing each executive department and agency to support the expansion of flexible, family friendly work arrangements [2]. Following these memoranda, The President's Management Council (PMC) endorsed a National Telecommuting Initiative (NTI) to promote greater use of home based telecommuting and telecenters by federal employees [3].

The Initiative calls for increasing the number of federal telecommuters from the current level of approximately 4,000 employees to 60,000 by the end of fiscal year 98. According to the GSA, this level of participation (roughly three percent of the federal workforce) has the potential to generate facility cost savings of \$150 million annually.

Reduced operating costs are only one of the many benefits of telecommuting. This paper discusses the advantages of telecommuting, pertinent telecommuting concerns, and

basic startup recommendations. Resources which promote telecommuting for SAS programmers at The National Institutes of Health, as well as associated World Wide Web resources are provided.

TELECOMMUTING OPTIONS

For federal employees and commissioned corps officers, the Flexible Workplace Arrangements Program (FWAP) allows employees to either work at home or from one of the established telecommuting centers near their homes [4].

- Work at Home - The most popular form of telecommuting. Employees conduct business from home one or more days per week.
- Telecommuting Center - A multiagency facility which is equipped with computers, office equipment, and copiers for those who drive long distances between their homes and official worksites. GSA has established centers in the Washington Metropolitan area and Southern California. Centers are accessible 24 hours a day and agencies are charged \$100 per day per workstation each month during the agreement period.

In addition to these options, private sector companies such as AT&T® [5] and Pacific Bell® [6] have also made the following telecommuting choices available:

- Satellite Office - A remote office location for employees of a single company to share. Usually this remote office is located close to a concentration of employee residences to reduce travel time and expense to and from the main office.
- Virtual/Mobile Office - Employees are equipped with all the tools and technology necessary to perform their duties from home or on the road (e.g. another office, customer location, airport, etc.).
- Hoteling - Shared company office space designed for drop in use. The space is generally equipped with standard office equipment and employees can either reserve a space or drop in as needed.

WHY TELECOMMUTE?

Nontraditional office arrangements have numerous advantages not only for employees, but for management and the environment as well. Government [1], [7] and private industry [5],[6], [8] web resources agree that telecommuting has the following advantages:

- Provides Financial Savings - Employees save money related to commuting expenses (e.g. fuel, parking, clothing, and eating out). Employers reduce overhead costs and may even be able to reduce/reorganize existing office space.
- Conserves Energy - Fewer automobiles during rush hour reduces traffic and parking congestion, reduces energy consumption, and lowers emissions for the environment.
- Improves Health - Employees benefit from less stress related to long rush hour commutes. Reduced traffic on the highways leads to fewer accident related injuries.
- Provides a Better Balance - Telecommuting provides a better balance between family and work demands. Time spent commuting can be spent with family instead. Families also have the flexibility to modify their schedules to meet the demands of ill family members, or to work at home when they are ill and are not up to managing a long commute to the office.
- Improves Productivity - Fewer distractions, meetings and unplanned interruptions lead to greater productivity. Time spent preparing for and commuting to the office can be utilized for accomplishing work related tasks. Greater productivity and accomplishments lead to greater employee morale.
- Allows for Employment Flexibility - Personnel who are disabled or ill due to temporary or existing health problems (e.g. pregnancy restrictions, cancer treatment, etc.) can be accommodated instead of being forced to use disability leave or early retirement.

ISSUES OF CONCERN

Although telecommuting has many advantages, participants and employers should be aware that it also has some potential pitfalls [6].

Supervisory Concerns:

In some cases, employees might be met with management resistance and skepticism. Some supervisors may feel that they cannot properly oversee employees who do not

work at the main worksite, or that telecommuting may be a burden on the other employees in the office.

Usually these concerns can be avoided by training and communications mechanisms and by coordinating the number of telecommuters within any one department. It is important to remember that telecommuting should not put extra strain on the workers in the office. Telecommuters should be highly accessible and notify coworkers when they are working outside of standard hours. Managers should also schedule regular meetings with telecommuters to give feedback, discuss problems, or assess new developments.

Employee Concerns:

One potential problem with telecommuting is that employees have access to the office 24 hours a day. This can sometimes lead to overwork. In most office environments there are subtle cues signaling when to start and stop working, but in a home environment, many of these cues are absent. It is very easy for the home worker to either work continuously without breaks or to keep working past quitting time to “just finish one last item”. Telecommuters need to define their workday with definite start and stop times and to schedule an appropriate number of breaks into each telecommuting day.

Another home related pitfall is procrastination. Telecommuters need to set firm rules for working at home. It is very easy to inadvertently get involved with household chores, the family, or errands, only to find that the whole day has passed without ever stepping into the home office. Set goals for each day and try to avoid getting distracted by other chores.

Home based workers must also remember that telecommuting is not a substitute for childcare. Telecommuters need to make arrangements for someone to care for their young children. Teleworkers cannot effectively care for young children and expect to accomplish work tasks. Likewise, they cannot expect to provide good care for their children if they are trying to concentrate on work. No one benefits from a parent trying to do both jobs (e.g. either the work does not get completed or the child does not get adequate care).

Isolation from coworkers can be another problem. Often times the telecommuter feels out of touch with office routines and news. This can be avoided by making regular visits to the main office or by keeping in touch with coworkers by phone calls or email.

Finally, the last areas of concern involve safety, security and support services. It is important when setting up your home office to consider general safety issues. For example, do not overload electrical outlets and keep

equipment cords neatly arranged to avoid trips and falls.

Telecommuters must also consider the security of their data and office files. Make sure office files are stored in a secure (preferably locked) file cabinet and any data is either password protected or secured from the possibility of curious little hands. Either store electronic documents on your main office computer or make sure you have a backup strategy for these files at home. Even if you do not have access to a sophisticated backup system, a copy of important files on a floppy or Zip® disk will provide great insurance against accidental deletions.

Also, telecommuters should have, in general, good computer security awareness. Teleworkers should regularly employ virus protection software, use passwords to access hard drives and sensitive data, and use encryption software to send sensitive or critical information by email [9].

Finally telecommuters should be aware that many of the support services that are readily available at the office, such as secretarial support, the copy machine, or office supplies will probably not be as accessible from home. Usually the lack of these items or services can be avoided by good planning. Make sure to keep extra fax and printer supplies on hand, so that you are not running to the nearest retailer when your 5 o'clock report deadline is fast approaching. It is also important to be flexible in your telecommuting routines. Don't insist on trying to work from home on a day when working from the office is more efficient.

WHO SHOULD TELECOMMUTE?

The Office of Personnel Management has set important guidelines suggesting who should be considered for telecommuting. Permission to telecommute should not be based on the employee's job title, type of appointment or work schedule. Work which is conducive for telecommuting are positions which require thinking and writing, such as data analysis and computer oriented tasks, telephone intensive tasks, case reviews or report writing. These types of jobs usually involve less face to face communications and have clearly defined tasks, work products, or objectives.

On the other hand, work that involves extensive face to face contact with other employees, a supervisor, or the general public may not be suitable. Working from home may also be unrealistic if the employee needs frequent access to files or materials that cannot be accessed electronically, moved from the main office, or the data require a high level of security that cannot be duplicated in a home environment [7].

GETTING STARTED

The first decision a potential telecommuter must make is whether working from home (or an alternate site) is an appropriate choice. Keep in mind that telecommuting requires dedication and hard work and it decreases the amount of available supervision and feedback from others. Teleworkers should be able to make independent decisions and adjust to a certain amount of social isolation. They should also maintain good organizational and time management skills, and be self-motivated. [10].

Once you decide to try telecommuting, the next step is to contact your personnel office to see what procedures are necessary for obtaining the proper approval. In the federal government, each agency sets up its own approval process and usually the employee's immediate supervisor will assess and grant permission for the request [7]. If the request is granted, typically the employee is asked to sign a written agreement designating terms such as work schedule, number of hours, equipment, supplies, compensations and cancellation policies [11].

ORGANIZING A HOME OFFICE

If you are planning to telecommute from a home office, it is important to take some time to think about your office and communications setup. The AT&T Telework Guide [5] and Pacific Bell Telecommuting Guide [6] are excellent resources for the beginning telecommuter. Both WWW (World Wide Web) resources offer detailed information on equipment and services available to work from home.

The basic equipment for any home office includes:

- Comfortable seating and an appropriate work surface. Since you will be spending most of your day in your home office, make sure you have a comfortable chair to sit in that is adjustable and ergonomically correct. Try to designate a specific location for your office. The kitchen table or other central activity location is not recommended.
- Good lighting. Lighting is typically the top environmental factor effecting productivity. Good lighting will avoid eye fatigue, strain and headaches.
- Personal computer or workstation. Make sure you have access to the computing resources you need to do your job. This can be in the form of similar equipment and applications in the home office or remote access to computers and applications running from the main office.
- Printer. The need for a printer will depend on how often you print and how many days you

plan to telecommute. If the need to print is low, printing can be deferred until the next time you are in the main office.

- Modem. Modems are telecommunication devices that allow your PC (personal computer) to communicate via a phone line. This will be your primary communication link to the main office. Using a modem you can connect to a remote computer, an office LAN (Local Area Network), online services, or send email.
- Fax Machine or Fax Modem. Modems with faxing capabilities are an added bonus as you can fax documents directly from your PC to the main office. The disadvantage to the fax modem is that documents which exist outside of your PC either can not be faxed or must be scanned into your PC before faxing. Stand alone fax machines are a useful convenience as they allow faxing of all document types, regardless of origination, and often have the added convenience of built in copy features.
- Additional Phone Lines and Services. If you are planning to work at home and connect to your main office on a regular basis, the addition of a second phone line will make doing your job from home more convenient. By installing a second line for your modem, you can still receive phone or fax messages while you are connected to the office. In addition to adding a second line there are optional services available for your main line (e.g. IdentARing®) which allows you to designate a separate number and ring for your fax machine. (For more information contact your local phone company.)

COMMUNICATION LINKS

When using a computer from home, the telephone line and a modem will be the basis of your communication link [6]. Fortunately due to advanced telecommunications solutions, many of the physical barriers that once required workers to be in their offices have been removed.

The Pacific Bell Telecommuting Guide [6] provides an excellent overview of the typical communications setups necessary to work from a home office. For terminal access to applications running on a central computer (low end access), one would need a personal computer with terminal emulator software and a modem. Most analog modems can reliably transfer data at a speed of 28.8 Kbps (Kilobits per second).

For mid-range access (terminal access and file transfer), one would need a PC, terminal emulator software, and a

file transfer package to move the data to your home PC. Additionally, you would want the same application packages on your home PC to manipulate the data after the transfer. One should keep in mind that file transfer over an analog modem will be much slower than transfers made from your main office with an ethernet connection. Also noise on your residential phone line can interrupt a data transfer, sometimes requiring several transfer attempts. This can be very frustrating if you intend to move large data files on a regular basis.

Another alternative for transferring files is remote access software. The Smart Valley® Telecommuting Guide [12] provides a quick overview of some of the more popular remote access software for Windows® and the Macintosh®. Remote access software allows your computer to communicate with a compatible server over standard telephone lines giving you direct access to the resources at a remote location. This is a very convenient way to access files from your office computer or other servers on your company LAN.

Remote control software such as Timbuktu® Pro (Windows and Macintosh) is also available for users who need to control the desktop of another computer from home. This software is particularly useful for employees who need to administer databases and/or applications remotely.

However, for regular transfers of large amounts of data (high end access), it would probably be wise to invest in a high speed digital communications link. For telecommuters in the North East region, the Bell Atlantic® web page for residential services provides a wealth of information [13]. Some of the more popular residential high speed links include:

- ISDN - Integrated Services Digital Network is a three channel digital line (two working B channels and one administrative D channel) that supports concurrent data, voice, and video transmission over one phone line. ISDN can provide download speeds of up to 128 Kbps. With an ISDN modem, users can be connected to the office and using a voice line at the same time. This type of connection provides greater connection stability, quicker file downloads, and fewer frustrations associated with analog transmissions. The cost is comparable to installing a business line in your home.
- ADSL - This is a high speed digital link based on Asymmetric Digital Subscriber Line technology. This service provides a dedicated residential link to the internet and remote LANs that is twelve times faster than a 56 Kbps analog

modem. The main advantage to this service is that it is an even faster digital connection. Like ISDN, you can still use your telephone or fax machine while placing a data call with an ADSL modem. The monthly fee for this service ranges from \$39.95 to \$109.95 per month based on the speed of the service chosen 640 Kbps to 7.1 Mbps (Megabits per second), respectively.

- **Broadband Services** - This is a relatively new service becoming available through your local cable or telephone company. This is a high speed network (100-200 times faster than ISDN) transporting voice, interactive video and data services. Bandwidth is shared between you and your neighbors and near ethernet speed (approximately 10 Mbps) will be obtainable at home. This medium will offer an even faster means of connecting to LANs and online services. Broadband services are currently under development and will bring a host of new capabilities, which are currently unavailable using today's public networks, to telecommuters in the future.

NIH RESOURCES

The National Institutes of Health (NIH) readily supports the President's Telecommuting Initiative to make work at home strategies more accessible to federal employees [14]. Two services which provide NIH employees with the connections they need to do their jobs from remote locations are NIH PARACHUTE and NIH SILK Web Services. PARACHUTE is a telecommunications service which provides NIH employees with a means of connecting to the NIH network and the WWW remotely. NIH SILK is a web service that provides secure data access and delivery.

NIH PARACHUTE

PARACHUTE is a remote access service (available to NIH employees only) provided by the Center for Information Technology (CIT) branch which allows NIH staff access to campus computing resources (e.g. NIH LAN, the internet, NIH servers and printing facilities, and email) from off campus using a standard modem and telephone line [15].

PARACHUTE is an acronym for PPP and Apple Remote Access Central High-Speed User Telecommuting Engine. PARACHUTE has been available to NIH employees since January 1996 and gives remote users the same access to network services as employees on the NIH campus, but at modem speeds [16].

PARACHUTE supports several communications protocols (e.g. Point-Point Protocol (PPP), Apple

Remote Access (ARA), Serial Line Internet Protocol (SLIP), and Telnet). PPP is generally recommended for connecting to PARACHUTE because it can be run from any computer (Windows, Mac or Unix). Presently PARACHUTE can accept 189 simultaneous modem connections. 56K modems can connect to PARACHUTE at a data transfer rate of 33,600 bits per second [15].

For NIH employees, getting connected from home is a snap. The first step is to contact CIT (301-594-DCRT) to apply for a PARACHUTE account. Once accepted, the employee will receive a User Name and Password which is necessary to configure the account. The next step (if not completed already) is to install and configure a modem for your home computer (28.8 or 33.6 Kbps modems recommended).

For Windows 95, users must configure the "Make New Connection" wizard in "Dial Up Networking", and install and bind TXCP/IP to the "Dial up Adapter". For the Macintosh, users must install PPP, and either Apple Remote Access (ARA) or FreePPP (a TCP/IP dialer program). ARA software will allow users to access files on Appletalk file servers, whereas FreePPP will not. Once one of these remote programs has been installed, users configure the application to dial up the NIH central server which authenticates their User Name and Password, allowing a connection to the NIHnet [15].

The Center for Information Technology is continuously evaluating new services and devices to make remote connections for NIH employees more efficient. Currently CIT is testing new devices (56K modem technologies, ISDN modems, and cable modems) to determine the effectiveness of these technologies on boosting the speed of remote access connections.

NIH SILK

In January 1997, The Center for Information Technology introduced **S**ecure **I**nternet-**L**in**K**ed web technology on the NIH campus (SILK) [17]. The SILK web technology allows NIH employees to create and maintain their own web servers. SILK is a convenient means by which NIH employees can easily access and display information to others in their group. The benefit of SILK is that users can post their own data, reports or output on the web, instead of distributing hard copy versions to coworkers. This is particularly useful for remote workers since the distribution of hard copy reports would soon become costly (e.g. postage) and inefficient (e.g. the data could become outdated before it is received). An additional benefit to SILK users is that CIT handles all the server hardware, software, security, and maintenance.

Users of the SILK web services can easily display MVS SAS data and output for colleagues by saving the output

with the following syntax:

aaaaii. @www.filename

The SILK system allows immediate web access to virtually any type of data (e.g. text, HTML, GIF, JPG). Users with CIT accounts can choose to serve data from either a public server (accessible by anyone), <http://silk.nih.gov/public/>, or a secure server that takes advantage of the MVS RACF (Resource Access Control Facility), <http://silk.nih.gov/secure/>. Files saved with RACF protection, which restricts access to specific individuals or groups, access their files via the secure server, whereas, all unprotected files are accessed by way of the public server [18].

NIH has a number of facilities on SILK available to employees with CIT accounts that are advantageous to those who perform their jobs remotely [19]. (For a complete list see Table 1.)

- SILK Locator - A web interface which allows users to search for specific SILK web servers and their owners (unrestricted access).
- Web RACF - A web interface that allows SILK server owners to designate security for their data sets. Each SILK server owner can designate one of three security choices:
 - a) Unrestricted Access - anyone with a browser can access the site.
 - b) Registered Users - anyone with a NIH Computer Center account/initials combination can access the site.
 - c) Designated Users - limited to DCRT registered accounts and a group password.
- Web Sponsor - A web interface which allows Computer Account sponsors to display account information, open new accounts and modify existing accounts.
- Web Listoff - A web application that allows programmers to obtain a listing of data or programs without logging into WYLBUR or TSO.
- Web Submit - A web application that allows Computer Center users to submit MVS batch jobs (e.g. SAS jobs) via a web interface. Users complete a form and press a submit button and the job number of the batch job is displayed.
- Easyemail - A web application that allows users

to send email to any internet address without having email software installed on their computer. This is a great facility for users who need a quick way to send an email from a remote location. (Note: this is a send only mechanism, there are no receive capabilities).

- Easyforms - A web application that sends information collected on a web form to a designated email address. This facility provides an easy means for NIH users to received information collected on a web form.

SAS RESOURCES

The SAS System offers several types of remote access solutions for programmers who wish to complete their assignments from locations other than the main office. SAS/CONNECT® Software and SAS/SHARE® Software are two client-server products which allow users to connect to the computing and data resources of the SAS System from their local desktops. Based on the client-server model where a first process requests data or services from a second process executing on a remote machine, both products are particularly useful for employees who wish to access SAS resources from their home or another remote location.

SAS/CONNECT SOFTWARE

SAS/CONNECT software is a data access tool which is used to connect two SAS sessions on different computers. This product allows you to connect to multiple remote SAS sessions, process applications, access data from a remote SAS session on your local machine, and to combine SAS data from incompatible systems into one data set [20].

SAS/CONNECT Software consists of two main services, *compute services* and *remote data services*. The compute services consist of remote session processing (RSUBMIT and RSPT), whereas the remote data services consist of data transfer (UPLOAD and DOWNLOAD) and remote library services (LIBNAME).

In a typical SAS/CONNECT session a link is established between two SAS sessions running on different hosts. Once the connection is established the user has access to the services and resources available to both sessions.

As a remote access tool SAS/CONNECT can be extremely useful as it allows telecommuters to utilize a variety of resources not available on their local desktop. Some of the advantages of SAS/CONNECT software are:

- Users may have access to other SAS licensed products (e.g. SAS/STAT®, SAS/GRAPH®) on a remote system that is not available on their

home system.

- The amount of data at the main office may be too large to move and/or the processing can be completed more efficiently on the office system than on a local desktop.
- The data is too dynamic (e.g. it is updated too frequently), making continuous transfers to the desktop for analysis inefficient.
- Multiple SAS files can be transferred in a single step.
- SAS files can be seamlessly moved between releases or across operating systems.

(For a complete explanation of this product, see SAS/CONNECT Software, Usage and Reference [20].)

SAS/SHARE SOFTWARE

Another remote access solution from SAS Institute is SAS/SHARE software. This product is often employed when multiple users need to update the same SAS data libraries or SAS files concurrently. Generally, the file systems on most operating systems prevent multiple users from accessing or making changes to the same file. However, through the use of SAS/SHARE software, the same libraries or files can be modified while ensuring that inconsistent changes are not made or important new information is not overwritten [21].

Several advantages to SAS/SHARE software have been noted by Aster [21]:

- Multiple users can modify or update separate observations in a SAS data set or catalog.
- The software works without modifying current SAS programs.
- SAS/CONNECT and SAS/ACCESS® software can be employed in combination with SAS/SHARE software.
- SAS/SHARE allows file sharing between the MVS and CMS operating systems.

SAS WEB TOOLS

Within the last few years, there has been an explosion of Web products designed to make remote access to information and services more convenient. Many private companies and government agencies have their own web sites displaying static information and internal intranets containing information and services for employee access.

The Web is a universal interface for distributing information in a timely and efficient manner. Today, web browsers work on most operating systems and users need only learn minimal skills (e.g. pointing and clicking) to utilize resources posted on the majority of web sites.

SAS Institute has developed a full range of web solutions ranging from static information delivery (Web Publishing Tools) to web applications allowing users to generate dynamic information on demand (SAS/IntrNet™ Software) [22].

Web Publishing Tools

Of the SAS Web Publishing Tools available to date (See Table 2 for a complete resource list), the HTML (Hypertext Markup Language) Formatting Tools have assisted SAS users in delivering static data and reports in a timely manner.

There are three types of SAS HTML Formatting Tools:

- HTML Output Formatter - saves output from any SAS procedure to an HTML file.
- HTML Data Set Formatter - converts SAS data sets to HTML 3.x tables.
- HTML Tabulate Formatter - Converts Proc TABULATE output into HTML 3.x tables.

No knowledge of HTML is required to use the SAS HTML Formatting Tools. This collection of web tools (available for Windows, MacOS, Unix, OpenVMS, and MVS systems) allows users to easily create SAS output with valid HTML tags (not just output surrounded by the <pre> tag). Each of the formatting tools is written as a SAS macro which defines a set of properties to format the text of the output. Either the default properties can be used or users can customize their own properties [23].

SAS/IntrNet™ Software

SAS/IntrNet™ software is a set of dynamic applications that allows users to create and deploy web enabled applications providing remote access to data and computing power from any desktop, regardless of whether SAS software is locally installed.

SAS/IntrNet™ consists of ten components (see Table 2) which can be used alone, or combined to provide a solution that best meets the needs of your organization. The SAS Web Tools Product Index [22] and SAS/IntrNet™ Software: Delivering Web Solutions [24], provide a detailed overview of the suite of tools outlined in Table 2.

Two of the more popular SAS/IntrNet™ components are the Application Dispatcher (a compute service) and htmSQL (a data service). Both products use the Common Gateway Interface (CGI) technology, which is a programming interface that resides on a web server and communicates with an external program when a request is submitted via a web browser (CGI URL).

The Application Dispatcher

The Application Dispatcher is a powerful report distribution and analysis tool. It allows programmers to build a web application that accesses and deploys a SAS program, which can be available to any number of users, even though SAS software is not installed on the desktop.

The Application Dispatcher consists of:

- An HTML Formatted Web Page - a HTML form, a hypertext link to the Application Broker, an inline image, or an object (e.g. a Java™ applet, ActiveX™ control, or Plug-in), that sends an immediate request to the Application Broker.
- Application Broker - a CGI program that resides on a Web server and interprets a form request and passes it to the Application Server.
- Application Server - A SAS session that receives and processes information from the Application Broker. Results are sent back to the Broker, which in turn, sends the results back to the user's Web browser.
- Dispatcher Applications - SAS code (a program, source entry, SCL entry, or compiled macro) which accepts the form information that is passed from the Application Broker.

To effectively use The Application Dispatcher, one should be skilled in HTML and SAS programming [24].

htmSQL

HtmSQL is a popular data service component of SAS/IntrNet™ software. It is also a CGI program which resides on a web server and can be used to access and modify SAS data from a web page.

To use htmSQL the programmer provides an input file which contains SQL (Structured Query Language) queries imbedded in the HTML. The htmSQL tool then formats the query results based on the programmers instructions. The main advantage to this solution is that each web query is dynamically processed so the displayed results always contain the most current data.

For htmSQL the critical element is the input file. This file creates the application interface, defines the SQL queries, and specifies how the results are displayed. The query section of the input file generally contains the following:

- sql section - specifies the SQL query that is sent to the SAS server.
- eachrow section - describes how to display the results of the query.
- norows section - designates application behavior

when a query does not return any rows.

To effectively use the htmSQL tool, users should be familiar with HTML and SQL.

Again, these are simply a selection of several of the SAS Web Tools components. For a detailed explanation of the available products, as well as demonstration programs, platform availability, and instructions for use, readers should refer to the online SAS Web Tools documentation [22].

CONCLUSION

Never before has there been so many resources and solutions for employees wishing to work remotely. Telecommunications innovations such as high speed digital links are becoming available to more and more residential areas so employees can access data at more efficient speeds. Employers are providing services which promote easy access to work, the network, software and data (e.g. NIH PARACHUTE and SILK). Companies such as SAS Institute continue to develop web based applications (e.g. Web Publishing Tools and SAS/IntrNet™ Software) providing platform independent, secure applications for accessing and publishing data.

With today's technological innovations, most work no longer needs to be location sensitive. Telecommuting has redefined the workplace we once knew. The NIH Office of Telecommunications Management has wisely noted that employee contributions should not be measured by where a person sits, but by the value that employee brings to their organization [25].

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Table 1. NIH SILK Web Facilities

NIH SILK Web Facilities	URL
Customized SILK Servers—Management	http://silk.nih.gov/msilk/
SILK Locator* (Does not require DCRT Account for access)	http://silk.nih.gov/locator/
Web RACF	http://silk.nih.gov/racf/
Web Sponsor	http://silk.nih.gov/sponsor/homepage
Web Listoff	http://silk.nih.gov/listoff/
Web Submit	http://silk.nih.gov/submit/
Easymail	http://silk.nih.gov/easymail/
Formsmail	http://silk.nih.gov/formsmail/doc
Database Technologies (DB2® and Oracle®)	http://silk.nih.gov/dbtech/
Oracle Site License Information	http://silk.nih.gov/silk/Oracle/
NIH Backup And Recovery Service (NBARS)	http://silk.nih.gov/silk/NBARS/
National Center For Medical Rehabilitation Research	http://silk.nih.gov/silk/NCMRR/
Human Resources Information and Benefits System (HRIBS)	http://silk.nih.gov/hribs/display/

Table 2. SAS Web Tools

SAS/IntrNet™ Software	Description	URL
Application Dispatcher	Web gateway providing data access, analysis, and presentation procedures.	http://www.sas.com/rnd/web/dispatch/index.html
MDDDB Report Viewer	Multidimensional database (MDDDB) report and graphics generator and viewer.	http://www.sas.com/rnd/web/mddbapp/index.html
htmsQL	A CGI program that performs SQL queries and updates. Returns the results in HTML.	http://www.sas.com/rnd/web/htmsQL/index.html
SAS SQL Library for C	A library of C functions used to send SQL queries to remote hosts.	http://www.sas.com/rnd/web/sasSQL/index.html
Warehouse Viewer	A sample application that locates and accesses data warehouses and builds dynamic HTML pages.	http://www.sas.com/rnd/web/wviewer/index.html
SAS/SHARE*NET Driver for JDBC	Access and update SAS data via Java programs.	http://www.sas.com/rnd/web/java/jdbc/index.html
JConnect	Provides Java classes that communicate with a SAS session.	http://www.sas.com/rnd/web/java/jconnect/index.html
JTunnel feature	Addresses common Java Applet configuration problems.	http://www.sas.com/rnd/web/java/tunnel/index.html
JViewer applet	Java applet that displays the capabilities of JConnect and the SAS/SHARE*NET Driver for JDBC.	http://www.sas.com/rnd/web/java/jviewer/index.html
Metaspace Explorer applet	Java applet that allows browsing of information contained in a data warehouse.	http://www.sas.com/rnd/web/java/jwn/index.html
Web Publishing Tools		
SAS Automation Plugin	Enables a push button on a web page to perform a SAS action.	http://www.sas.com/rnd/web/plugin/index.html
GIF and IMGJIF Drivers	Support the creation of GIF images.	http://www.sas.com/rnd/web/driver/GIF/index.html
GIFANIM Driver	A mechanism to create animations.	http://www.sas.com/rnd/web/driver/GIFANIM/index.html
SAS IMGJPEG Driver	Produces output in the JPEG File Interchange Format.	http://www.sas.com/rnd/web/driver/JPEG/index.html
GGRAF Procedure	Creates three dimensional, clickable charts in VRML for drill down capabilities.	http://www.sas.com/rnd/web/ggraf/index.html
VRML Browser	Browser used to view VRML 2.0 files.	http://www.sas.com/rnd/web/vrml/index.html
HTML Method for the Table Editor	Converts tables from a Table Editor format to a web page format.	http://www.sas.com/rnd/web/TableEd/index.html
HTML Formatting Tools	Formats SAS data or output in HTML.	http://www.sas.com/rnd/web/format/index.html