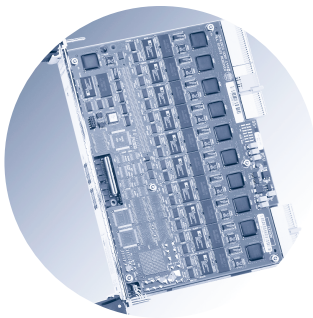
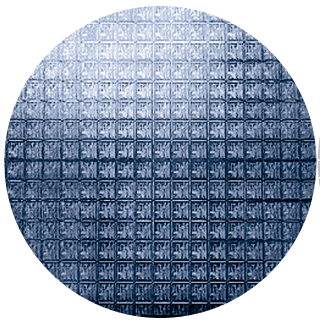
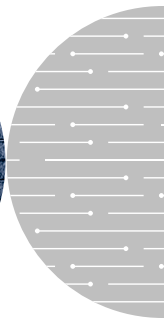
Whitepaper

Practical Telecommuting Technologies

Intel in Communications







Contents

Executive Summary

In today's increasingly information-based economy, telecommuters make up a fast-growing and surprisingly diverse segment of the workforce. The one thing they all have in common is that they choose to spend more time and energy on work and less of it traveling to work.

The telecommuting phenomenon took hold during the 1990s, with the number of Americans working at home three or more days a week jumping to 28 million by the end of 2001 according to the International Telework Association and Council (ITAC). This same group predicts that almost one-third of the workforce — some 50 million workers — will telecommute either full- or part-time by 2006.[1]

Telecommuting continues to grow in popularity because it simply makes sense — to the employer as much as to the employee. The advantages to workers of telecommuting are obvious: more flexibility and less time wasted on the road. Less obvious, but equally compelling, are the advantages to employers: lower overhead costs, higher productivity, access to a broader pool of talented workers, and greater employee satisfaction. Telecommuting is even good for the environment, helping to relieve traffic congestion in crowded metropolitan areas.

Also driving the growth of telecommuting is the increasingly easy communication between office and home, notably advances in voice over Internet Protocol (VoIP) technologies and the availability of digital PBX-IP gateways. Today's telecommuters can link into the company's network and private branch exchange (PBX), enjoying the same Web and email access and phone functionality as office workers. Moreover, the difference between communicating with on-site and off-site workers can be invisible to customers and other callers — making it even easier to view work as an activity, not a location.

This paper explores both the whys and hows of telecommuting, including telecommunications options and key requirements for setting up a home office that meets the needs of everyone concerned: the employee, the employer, and their customers.

Keeping It Balanced: Why Workers Like Telecommuting

Not everyone can telecommute. For example, factory or lab workers need more than just a PC to do their jobs. Workers who spend much of their time in meetings probably need to be on-site at least some of the time. However, many office workers do not need to be in the office five days a week to do their work. And they are turning to telecommuting — either some or all of the time — to improve their work-life balance, free up the time they waste traveling to and from work, and improve their productivity.

Statistics from both the U.S. Census Bureau and ITAC show that most telecommuters are concentrated in areas with dense populations and high traffic congestion. In the U.S., this is principally the New England states and the East and West coasts. Telecommuters tend to:

- Be male
- Hold professional, sales, or managerial jobs that pay more than $40,000 per year
- Work for either very large or very small companies[2]

Telecommuters can range from occasional ("I need to be home this afternoon to let the repairman in.") to permanent ("I live two hours from the office."). Typically, they include:

- **The truly remote worker.** A company's ideal employee may live an hour's commute — or even across the country — from the office. With telecommuting, location is not important. Today's communications technologies can make anyone an integral part of a virtual team with members working anywhere in the world.

[1] Testimony to U.S. Congress of Timothy J. Kane, president of International Telework Association and Council, September 24, 2002.
[2] Telework in the United States: Telework America Survey 2001, of International Telework Association and Council.

- **The part-time telecommuter.** Workloads go up and down. When they are up, workers can find themselves camped out in the office around the clock. Having the ability to work from home during busy times — or when bad weather or other natural disasters create commuting nightmares — makes it much easier to get all the work done. Busy employees who are set up to work from home are able to keep up with their workload and still take time out to pick up the dry cleaning or sit down to dinner with the family. A better work-home balance helps to minimize employee burnout.
- **The disabled worker.** Over the last decades, employers have increasingly tapped into the vast talent pool of workers with physical disabilities. Telecommuting can be a cost-effective way for employers to access the abilities of this workforce without having to make specific — and expensive — facilities modifications that go beyond the requirements of the Americans With Disabilities Act. This can be especially helpful for small employers.
- **The parent with young or school-age children.** Many families have two parents working outside the home — which makes keeping a satisfying work-home balance a major challenge. Having at least one parent able to work from home makes it easier. For instance, when Johnny becomes ill at school, a telecommuting parent is generally available to pick him up and get back to work. If the kids need to stay home because of a snow day, Mom or Dad can still put in a full day of work without wasting time looking for a last-minute babysitter.

Boosting the Bottom Line: Why Employers Like Telecommuting

There is one very simple reason employers are embracing telecommuting: it makes good economic sense. In fact, having employees spend some or all of their work hours at home can help employers cut fixed expenses by as much as 40 percent[3], with savings on:

- Office space, furniture, and fixtures
- Parking facilities
- Utility bills

Telecommuting can also help employers attract and keep top talent. Offering a telecommuting option is one more employee benefit that can make an employer attractive. It can give employers access to expert help wherever they can find it — for project, contract, or full-time work. Allowing employees to work remotely can help employers save on recruiting and training costs and relocation allowances.

Once hired, telecommuters generally make contented employees. More than two-thirds of the telecommuters surveyed by ITAC said they are more satisfied — or much more satisfied — since they began working at home.[4] This can help improve a company's employee retention statistics and save even more on recruiting costs.

Finally, telecommuters are actually more productive than on-site workers. A study of 1,500 AT&T telecommuters, for example, showed that telecommuting increased employee productivity by 10 percent between 2001 and 2002, with employees typically gaining a full hour a day.[5] Other studies show similar — or even greater — productivity gains.[6]

The U.S. government is also beginning to promote telecommuting by offering incentives to employers who provide this option to their employees. In 1999, the U.S.Congress approved a pilot program in five metropolitan regions that gives companies pollution credits for letting employees work from home. Also, Senator John Kerry of Massachusetts has sponsored a bill to conduct a pilot program to raise awareness about telecommuting among small business employers and to encourage employers to offer telecommuting options to employees.

[3] Testimony to U.S. Congress of Timothy J. Kane, president of International Telework Association and Council, September 24, 2002.
[4] Telework in the United States: Telework America Survey 2001, of International Telework Association and Council.
[5] AT&T news release: Tuesday, August 6, 2002.
[6] Testimony to U.S. Congress of Timothy J. Kane, president of International Telework Association and Council, September 24, 2002.

Uncovering the Issues

Once an employer has made the decision to embrace telecommuting for employees who are good candidates, there are several key issues both the employer and employee need to consider before they can begin setting up a productive home office:

- **What kind of PC?** Will the employee use an existing home PC or one supplied by the company?
- **What kind of connection?** Will a dial-up line suffice? In most circumstances, it will not. In that case, is broadband access available to the employee's home?
- **How will the telecommuter make and receive phone calls?** This is just as important as how the employee will gain access to email and files. It needs to be easy for callers to reach the telecommuting employee.
- **How will you send voice over IP?** A telecommuting solution may need to connect IP telephones to the company's PBX, integrate network-hosted applications with the PBX, and extend the PBX to branch or home offices.
- **What kind of messaging solution?** The home-based worker needs easy, seamless access to voice, fax, and email messages.
- **What is the corporate culture?** Are the company's employees accustomed to interacting remotely using conference calls, email, and file collaboration? Or do they like to conduct business in the hallway? If the latter is more the norm, some adjustment might be necessary to accommodate teleworkers. But any corporate culture can adapt.

Once the prospective telecommuter and the employer have considered these issues, they can begin using today's telecommunications technologies to develop a home office solution that meets the needs of the telecommuter, the employer, and their customers.

Making the Work-Home Connection

Most of the issues involved in telecommuting can be easily solved with a laptop PC, virtual private network (VPN) software, a broadband Internet connection, a PBX gateway to enable voice to be transmitted over IP, and the right telephony endpoint.

Choosing the PC

Telecommuters who have home PCs already have a monitor, mouse, keyboard, and probably an Internet connection. However, if the plan is to use the existing home PC for work, the employer will need to set up an email profile, install and configure virtual private network (VPN) software, install applications, create and enforce security polices, and make sure the home PC has up-to-date virus software installed at all times.

A much easier solution is for the employer to supply the part- or full-time telecommuter with a laptop that can easily go back and forth from office to home. This way, all the worker's applications are configured on one PC. File back-up can be as simple as a Zip* drive or CD burner. Maintenance is easy because the telecommuter is using a company-standard PC with a standard configuration. The company's IT department can gain access to the PC on days when the telecommuter is in the office.

Elements of a Telecommuting Solution

- Laptop PC for portability and flexibility
- File backup mechanism (Zip drive or CD burner)
- High-speed connection for fast downloads and easy information transfer
- DSL or cable modem for high-speed Internet access
- Telephony endpoint: Soft-client with headset with PC acting as telephony endpoint, IP-based phone, or analog phone connected to one-port gateway in the home
- PBX-IP gateway to connect to the company's circuit-based PBX network and convert voice and call control data to IP
- One-port home gateway for connecting to the PBX-IP gateway and, ultimately, to the corporate PBX
- Gatekeeper or proxy server to control the address translation
- Unified messaging or unified communications solution for managing fax, email, and voice mail messages — anywhere, any time, from the user's device of choice

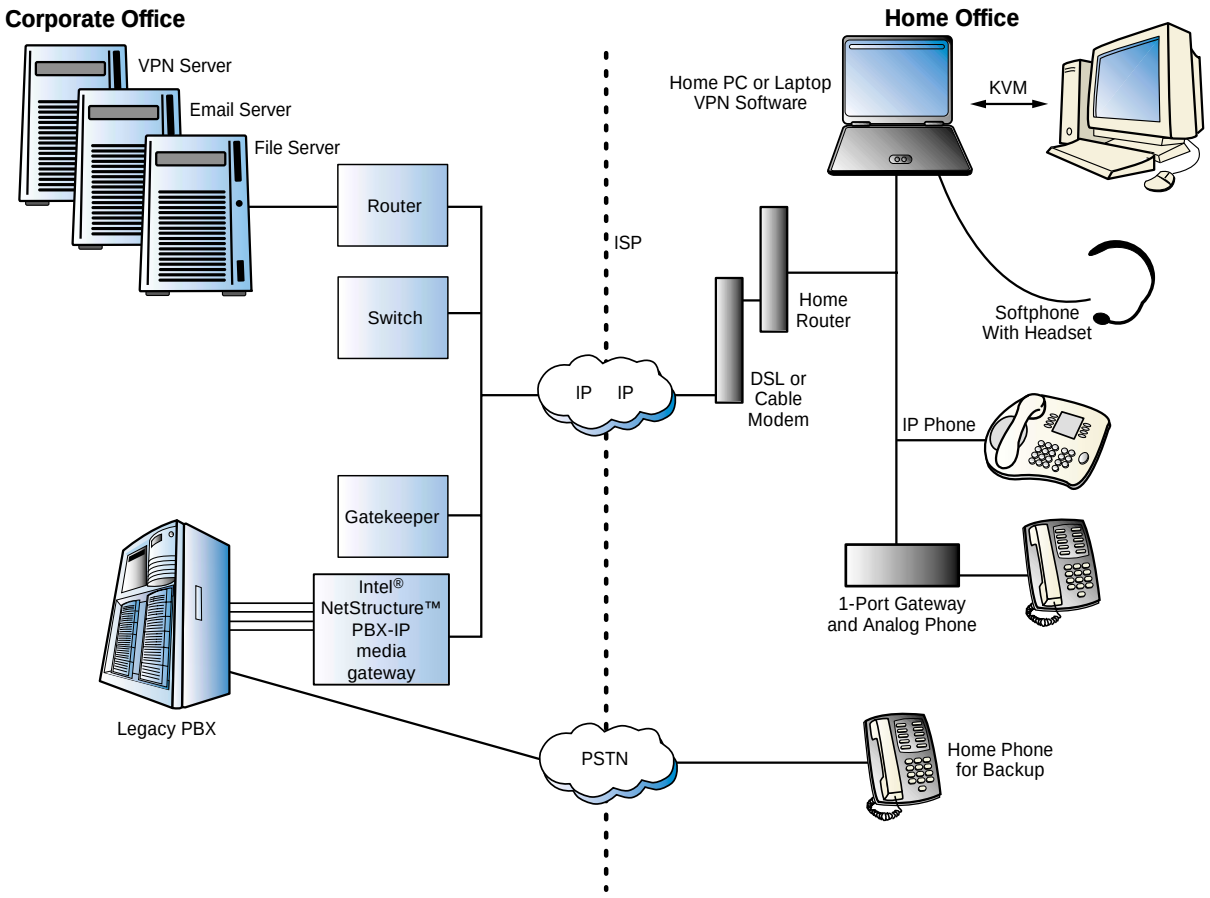


Figure 1: Connecting Remote Workers: Sample Scenario

If the employee is a full-time telecommuter, the PC will need to get back and forth to the office for service. This can be a hassle if the employee is hundreds or thousands of miles away. Even so, the laptop is still a standard configuration that the IT department can more easily maintain than the employee's own home PC.

And the employee's home PC can still be useful. If the telecommuter has a home PC with a full-size monitor, consider installing a keyboard/video/mouse (KVM) switch that will let the employee use the larger screen and a "real" keyboard and mouse with the laptop PC.

High-Speed Connection

A broadband connection to the employee's home is a key requirement for telecommuting: a dial-up connection just isn't good enough. First, moving large files over a dial-up connection is prohibitively slow. Equally important, a dial-up connection will never be able to handle voice on the network because of the low bandwidth and high latency.

Sending Voice Over IP

To connect IP telephones to the company's PBX — as well as to integrate network-hosted applications with the PBX and extend the PBX to home offices — a telecommuting solution needs:

- A PBX-IP gateway to connect to the company's circuit-based PBX network and convert voice and call control data to IP
- The appropriate IP endpoint

The Intel® NetStructure™ PBX-IP media gateway, connected between a PBX or a digital handset and a LAN, WAN, or managed packet network, converts proprietary digital PBX messages into a format suitable for transmission over standard IP networks. With a PBX, the gateway is used for emulation; with a digital handset, the gateway is used for phone driving.

Each gateway unit contains eight digital PBX (emulating) or digital station interfaces (phone driving) and a 10/100 BaseT Ethernet connection for connecting to a LAN.

An analog loop start unit designed for voice mail and unified messaging applications is also available to connect to PBXs that do not have an appropriate digital interface. The analog loop start unit supports several serial protocols for integrating IP applications to PBXs that support the SMDI, MCI, or MD110 protocols.

For the employer with a PBX system, the gateway provides a simple, cost-effective transition to voice and data convergence. Connected externally, it offers an IP solution that works with current legacy equipment. It supports H.323 or SIP-based applications running on network servers, remote terminals, or other devices.

Figure 1 shows a sample telecommuter configuration optimized for a part-time telecommuter who works from the office on some days and from home on others. With the PBX-IP gateway, callers can reach the telecommuter simply by dialing the telecommuter's normal office number. This feature — called simultaneous ring — eliminates many of the issues associated with managing a separate cell phone number. If the telecommuter is unable to answer the call, it simply forwards to the office voice mail box. There is no need to worry about checking a separate cell phone voice mail box. Also, using one broadband IP connection for both data and voice eliminates extra recurring charges for separate business phone lines.

To enable this VoIP solution, the PBX-IP gateway is connected to the legacy PBX or key system at the corporate office, along with gatekeeper software to perform some call routing and address translation. Next, the telecommuter connects to the gateway — and ultimately to the corporate PBX — using either an IP softphone, an actual IP phone, or a one-port home gateway connected to an analog handset.

The PBX gateway extends corporate PBX features over the IP network to the telecommuter at home, nicely complementing remote data access. Note that this scenario uses a digital PBX-IP gateway. If the gateway is not digital, the telecommuter will not have the benefit of simultaneous ring and will probably lose some caller ID information as well.

Telephony Endpoint

Choosing the right telephony endpoint greatly affects the caller's — and the employee's — user experience (Table 1).

In general, it is a plus for the telecommuter to have a cell phone because it is one more access point. But a cell phone is far from being a complete solution. Cell phone reception at the employee's home might be substandard. Also, if the employee relies on a cell phone, callers will have to call a second number after getting the employee's office voice mail.

Having callers dial the employee's home phone number solves the cell phone reception problem. But does the employee really want to give out a home phone number for inbound calls? Adding a second line would mean the employee wouldn't have to publish a home number. But callers would still need to deal with multiple phone numbers, and the company would need to incur the cost of the second line. Also, the company would need to pay for a second business line that would only be used part-time.

One way to solve the problem of two separate phone numbers is by having the telecommuter use an IP phone that can be set up to provide one-number access from both home and the office,

Key Phone Features for Telecommuters

- One-number access for easy, seamless communication between the telecommuter and the outside world. This is normally available only on digital PBX gateways, not analog gateways.
- PBX access allows the telecommuter to use the PBX's dial plan to call co-workers using their 3- or -digit extension, and to access outside lines just as if they were in the office. It also provides the telecommuter with features available to office workers.
- Message waiting, a light indicating the arrival of a phone message, relieves the telecommuter from having to constantly check voice mail to avoid missing calls. Setting up this feature may mean configuring the voice mail system to turn on an additional message waiting lamp for the telecommuter (namely, a port on the gateway).
- Caller ID gives telecommuters an added bit of information about callers — and every added bit of information helps when you are working away from the office. This feature is available on a softphone if the headquarters gateway supports it; however, it is typically not available on an analog phone, which normally has no display. This is another feature normally available only on digital PBX gateways, not analog gateways.

giving the employee access to office features such as a single voice mail box. The phone uses the same data connection as the employee's email and file access. There is no extra charge for an extra line. And, perhaps best of all, customers can reach the telecommuter using the company's standard speech-enabled auto attendant.

IP phones support real-time communication over the Internet by sending and receiving audio and video streams. They can provide a rich and engaging real-time communication channel. The drawback is that IP phones can be expensive. But this option is the most viable way to provide an "in-office" experience, giving the telecommuting employee access to must-have features.

End Point	Pluses	Minuses
Soft-client with headset with PC acting as telephony endpoint	• Easy to establish connection through VPN software on laptop because it's just another application running on the PC	• User only has a headset, not a physical phone • PC must be on to receive a call
Soft-client with USB handset	• User has the feel of a real phone especially if the handset is well integrated with the soft-client (for answering, dialing and hanging up)	• A little more costly because you need to buy the soft-client and the handset. • Won't work when the PC is off or hibernating.
Analog phone connected to one-port gateway in the home	• Lower cost than IP-based phone • User has a physical phone	• No Caller ID or message waiting • Harder to set up than IP-based phone because you need to give your IP phone access to the LAN through the firewall.
IP-based phone	• User has a physical phone • More office features than soft-client with headset • PC does not need to be on to receive a call	• More expensive than analog

Table 1: Telephony End-Point Choices

Another choice that is economical and practical is a soft-client with a headset, where the PC also acts as the telephony endpoint. However, some users do not like using the PC as a "phone," preferring instead the more familiar experience of a regular handset.

A good compromise might be to connect an analog phone to a one-port gateway in the home. This option is a lower-cost way to provide the "real" phone experience of the IP phone. The downside is that this setup does not provide all the features of an IP phone (e.g., caller ID, message waiting).

Again, no matter what the endpoint choice, it is essential to use a PBX-IP gateway that is both digital (to provide the features an analog gateway cannot provide) and truly standards-based (for the flexibility and expandability the solution will need to adapt as needs change). IP equipment will evolve and vendors will come and go. The right gateway should handle it.

Unified Messaging Solutions

Adding a unified messaging or unified communications solution provides a real advantage for telecommuters.

Unified messaging systems provide a single user interface to manage voice mail, fax, and email messages regardless of how the message is delivered. Unified messaging simplifies message handling by letting users view and print faxes and listen to voice mail messages — all from their email inbox. Users can also choose to have their email and fax messages read over any phone, any time, anywhere using text-to-speech (TTS) technology. Speech-enabled messaging solutions enable users to more quickly and easily sort through multiple media messages.

Unified communications takes unified messaging functionality one step further by delivering voice mail, fax, and email messages in real time through a single user interface. It also offers access to other tools that can increase productivity including calendars, contact lists, and corporate databases. Unified communications puts an ever-increasing amount of information at the telecommuter's fingertips, helping to speed transactions and workflow and making it easy to manage messages.

Changing the Culture

It will take some time for corporate culture to fully embrace telecommuting, but companies as large as AT&T and IBM — where about 25 percent of the company's 320,000 workers worldwide telecommute from home offices[7] — are already doing just that. The move to telecommuting is starting with global high tech corporations accustomed to remote collaboration. Workers at these companies are most likely to understand and deal with the technology involved.

Over time, a broader range of companies will come to realize that telecommuting has significant benefits for both the company and the employee. Once this realization hits, solutions will become even easier to deploy and configure.

Remaining Issues

The principal roadblock to easy, widespread telecommuting solutions remains quality of service (QoS) for the voice connection. Latency in real-time voice packets must be minimal enough to allow real-time conversations with toll quality. Too much delay can cause the parties in the conversation to "talk over" each other or produce an annoying echo. Several broadband service providers have begun addressing this issue by developing services that cater to VoIP users by providing QoS in their networks.

As the benefits of telecommuting become even better understood, the issues will likely be overshadowed by the benefits. A good analogy is cell phones, which are still much less reliable than landline phones but have exploded in popularity because of the convenience they provide.

Practical Telecommuting Technologies

Telecommuting will continue to expand because it simply makes sense — to the employer as much as to the employee. As more companies begin to see the benefits of a teleworkforce, a range of practical new telecommunications solutions will emerge to give telecommuters the same Web and email access and phone functionality as office workers. And it will become increasingly easy to view work as an activity, not a location.

[7] ITAC Telework News, December 2002.

Appendix: For More Information

Intel® Resources

- **Intel® NetStructure™ PBX-IP Media Gateway** (http://www.intel.com/network/csp/products/7135app.htm) — Data sheet explaining how this gateway provides a simple, cost-effective transition to voice and data convergence for enterprises with PBXs.
- **White Paper: Unified Messaging and Unified Communications in the Modular Network** (http://www.intel.com/network/csp/pdf/8538.pdf) — Explores the evolution of unified messaging into unified communications, the market segment and benefits of today's messaging solutions, strategies for building messaging systems today, and the role of modular network components in messaging solutions.
- **White Paper: Managed Migration to IP Telephony in a PBX Environment** (http://www.intel.com/network/csp/resources/white_papers/7756web.htm) — Legacy PBX equipment does not have to be replaced for enterprises to begin a phased migration to IP telephony. The Intel® NetStructure™ PBX-IP media gateway makes the implementation of IP technology in PBX systems possible right now.

Telecommuting Resources

- **American Telecommuting Association** (http://www.knowledgetree.com/ata.html) — Advice for employees who are or would like to be telecommuters.
- **AT&T Telework Web Guide** (http://www.att.com/telework) — Research, advice on policies, benefits, home or virtual offices, business cases, managing remote workers, and more.
- **International Telework Association and Council (ITAC)** (http://www.workingfromanywhere.org) — Founded in 1993, this non-profit organization is dedicated to advancing the growth and success of work independent of location. ITAC sponsors Telework America and other research, holds educational events, distributes publications, disseminates information about telework, and assists businesses and the public to optimize the advantages of working remotely.
- **Midwest Institute for Telecommuting Education** (http://www.mite.org) — A non-profit consulting group that provides expertise in strategic planning, manager/employee training, and policy development to assist successful implementation of telework arrangements.
- **U.S. Office of Personnel Management: Telecommuting** (http://www.opm.gov/wrkfam/telecomm/telecomm.htm) — Resources for setting up telecommuting for federal government agencies. Good general background information.

To learn more, visit our site on the World Wide Web at **http://www.intel.com**

1515 Route Ten
Parsippany, NJ 07054
Phone: 1-973-993-3000
Fax: 1-973-993-3093

Printed in the USA Printed on recycled paper. 03/03 00-8141-001