Information Technologies for Electronic Delivery

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SUMMARY

Information technologies will offer almost limitless opportunities for electronic delivery of Federal Government services in the near future. OTA identified six electronic delivery "points of access" that are now or will soon be technical y feasible using a wide range of technologies. These categories are not exclusive; in fact, several overlapping approaches are often preferable to a single method of delivery, and some technologies can be used in several categories.

1. Homes and offices. Services can be delivered direct] y to the citizen in the home, office, school, library, clinic, and elsewhere via telephones and computers. This direct access may be the most effective in the long term, but only if the services are user-friendly and include helpful directories. Computer-based delivery favors the still relatively small but growing number of homes with personal computers. The Federal Government might therefore need to take steps to assure access to computer-based services in local libraries, schools, and community centers, or via telephones and future interactive television services.
2. Neighborhood electronic kiosks. An electronic kiosk is a computer station that combines sound, video, and graphics to provide services in a shopping mall or other central location. Kiosks are accessible after working hours and on weekends. To be effective, a kiosk must offer a valuable service to the public and provide information that is updated regularly. The Federal Government could help promote the standards-setting process for kiosks so that Federal, State, and local agencies could coordinate their efforts and realize economies of scale. The long-term value of kiosks is unclear, however;

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many kiosk-based services eventually may be delivered more simply and inexpensively directly to the home, or may be more effective via a one-stop service center.

3. Community one-stop service centers. The Federal Government could colocate agency offices that deliver related services so that citizens can go to one location to meet many or all of their service needs. By sharing facilities, agencies could save money and increase their effectiveness. If the logistics of physical collocation are too difficult, agencies could use desktop videoconferencing, for example, to establish a "virtual" one-stop center. An extraordinary level of cooperation among Federal, State, and local governments would be required to make one-stop centers effective.
4. Mobile access. To reach citizens who are traveling, in remote or distressed areas, or otherwise isolated, a "mobile service center" could use technologies such as cellular telephones, laptop computers, and satellite receivers to provide services. The Federal Government could fund a pilot project on mobile service delivery in rural or distressed areas where mobile services could be most valuable.
5. Stores and banks—Electronic benefits transfer (EBT). EBT includes the use of card technologies to deliver public assistance or other benefits electronically to citizens using automated teller machines (ATMs) and point-of-sale (POS) terminals in stores. EBT promises to reduce theft and fraud in benefit programs, as well as reduce errors, paperwork, delays, and the stigma attached to paper checks and coupons issued by the government for social assistance. Of the many card technologies available, magnetic stripe cards are inexpensive and standardized, and can be used with existing ATMs and POS terminals. Smart cards, with an embedded microprocessor, are more secure and can store much more data than magnetic stripe cards. (EBT implementation issues are discussed in ch. 4.)
6. Businesses and health care providers-Electronic commerce and electronic data interchange (EDI). Overlapping with other points of access, electronic commerce includes technologies intended to reduce paperwork and delays, mainly for government-business transactions such as billings, procurements, or regulatory filings. EDI already is saving money for the Federal Government and has well-developed international standards, but agencies are slow to adopt EDI methods.

Federal agencies collectively lack a technology strategy for delivering services electronically. Various Federal agencies, and many State and local governments, are already engaged in electronic delivery, but generally on a piecemeal basis. Congress and the President could oversee the development of a technology strategy to coordinate service delivery among providers. Participants could include, for example, the National Institute of Standards and Technology (NIST), General Services Administration (GSA), National Telecommunications and Information Administration (NTIA), and agency representatives, perhaps working through an interagency committee. This technology strategy could be part of a larger strategy for service delivery discussed in chs. 1, 5, 6, and 7. A technology strategy could both identify technical trends and opportunities and help Federal employees better understand how to conceptualize the use of these technologies for delivering services. It also could facilitate communication through user groups, workshops, conferences, and publications.

A technology strategy emphasizing open systems would encourage procurement of off-the-shelf technologies to benefit from innovation in the marketplace, allow easier upgrades to existing systems, and improve interoperability. Open systems would allow agencies to have greater flexibility in selecting equipment and software, but within an overall governmentwide technical framework. The technology strategy also could

coordinate and promote the development of technical standards to help assure that rapidly developing technologies are compatible and cost effective.

To meet citizen needs, a technology strategy should emphasize user-friendly interfaces and directories. Government services can be easily degraded and depersonalized if cutting costs takes priority over assuring meaningful citizen access. Also, electronic delivery intensifies the need to ensure security of the electronic documents and transmissions to make certain that private and proprietary information is protected. Finally, a technology strategy must assure affordable access to advanced telephone and computer-based services so that some citizens are not bypassed by changing technologies (telecommunications infrastructure issues are discussed inch. 3).

VISIONS OF ELECTRONIC DELIVERY

The following fictional scenarios portray three perspectives of what Federal Government service delivery could be like in the not-so-distant future. The stories are about different people in different situations and how they might actually react to well-designed systems. They also offer a glimpse of how the government "starts over" in its approach to citizen needs, how it forms partnerships with the public and private sectors, how it assures equity of access for disadvantaged and rural citizens, and how it applies different technologies as appropriate.

Starting Over

The first story is about a low-income urban couple in which the husband has recently become disabled. They visit a "one-stop service center" where a social worker uses desktop videoconferencing and expert system software to coordinate their benefits. They later use a card at a local grocery store to receive benefits electronically, It is also a story about a change in the way the government delivers services: starting over.

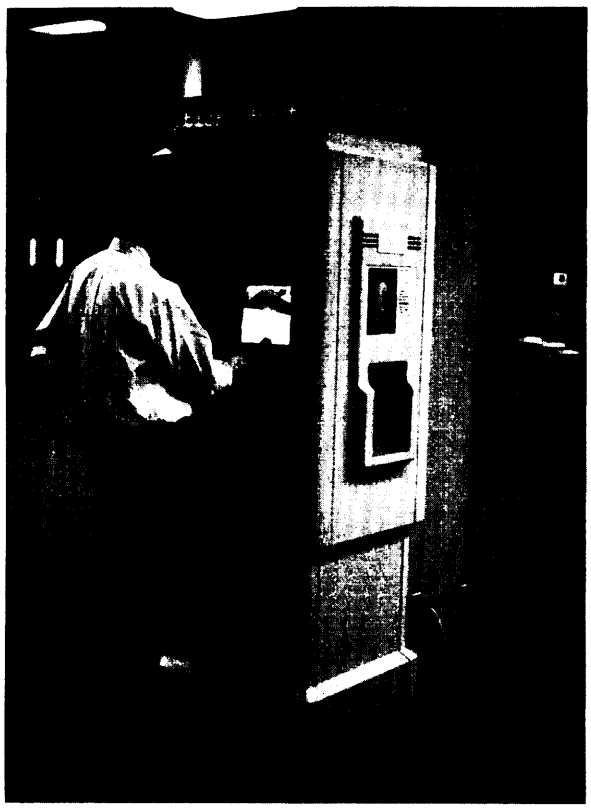
"I don't know whereto begin-everything happened so fast," Jim said to the social worker. After the accident disabled him, Jim and Suzanne had to think about helping him recover, getting her a job, arranging his benefits, and getting help with the children. He had been a self-employed painter, and she took care of the children. He can't work as a painter again, they have no savings, and they don't know what to do. Suzanne remembered hearing about a "one-stop" service center at the hospital that offered all community services in one office. They decided to try it.

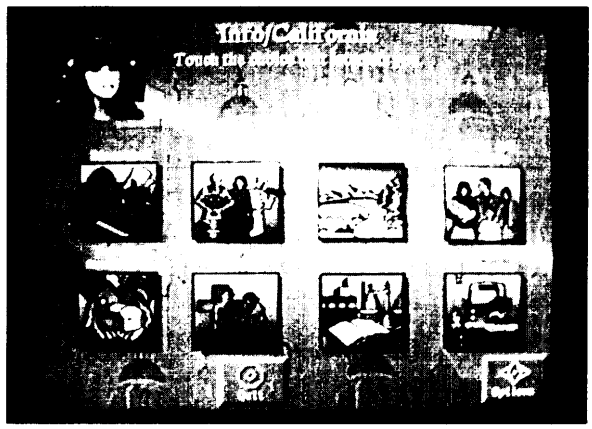
After listening to their story, the social worker entered some information into the computer. He doublechecked definitions, asked questions, and let the computer do its own processing to see if he has thought of all the possible options. The benefits range over many agencies, from local and nonprofit groups to Federal providers of social security benefits, tax benefits, veterans' benefits, and food stamps.

This is a new kind of government worker—an information and referral specialist who is cross-trained over many levels of government and outside agencies. While the computer program helps the worker provide correct and consistent answers, it can' t think for him, Even the latest software only recites rules and examples or checks logic; it cannot understand the intent or nuances of the regulations. "What is 'training' in this context and what kind of training does Jim qualify for?" the worker wondered. He called a colleague at another service center in the State who knows all about training, This was not a telephone call Suzanne and Jim were familiar with; the worker called by computer. By pointing the electronic "mouse" to icons on the screen and clicking, an image of the other social worker appeared on the computer screen ready to speak with him.

Distributed Services

The social worker explained to Suzanne and Jim that government services—and computers—are more "distributed" today than they were a few years ago. Social workers work more closely with citizens, and they communicate with each other by computer or telephone. They even receive training





PHOTOS: FRED B. WOOD

Left: The Info California pilot kiosk located in the main library on the campus of California State University at Sacramento. Other kiosks are located in grocery stores, shopping malls, and government offices.

Right: InfoCal kiosks use touchscreen technology to facilitate citizen access to information (in both English and Spanish) on a wide range of California government services-including education, family, health, housing, and employment.

through these or larger videoconferences, eliminating the need for everyone to be in one place. When the one-stop pilot project began back in the 1990s, the computer and videoconferencing equipment weren't compatible among different agencies, but now all the local information and referral workers are connected. Suzanne and Jim didn't really care what "distributed" meant-but the services did seem much more human.

Getting people from different agencies and governments to work together was the real challenge, however. In fact, the pilot project wasn't successful in every State that tried it-every State is different. It required top-level Federal leadership—both congressional and executive—and similar leadership at State and local levels, too. The local leaders were more aware of the specific needs of the community. Innovators were allowed to test their ideas within the basic framework (what the "techies" call an "open system"), The Governor had called the whole process "starting over with government services."

Getting a Benefits Card

The social worker gave Suzanne and Jim a card for getting interim food stamp benefits at the grocery store. The "food card" looks like a credit card. They watched a videotape about it and also tried it a few times in the office. Jim felt somewhat discouraged about depending on others for support. The benefit card looked like just another credit card, though, and Jim felt better knowing that he doesn't need to use paper checks or coupons. The card system is also quicker and easier for the retailer, and the Federal Government benefits because the password cuts down on fraud and stolen benefits.

At the store, the clerk treated them like any other customers. Suzanne put the card through the

"point-of-sale terminal." She typed in the password and got a receipt. Suzanne remembered vaguely that the social worker said the card could access different benefits within the same transaction. Today she used a Federal-State program for baby food, cereal, and milk, and a different State-local program for diapers. The card made the determination automatically, debited the accounts, and showed the remaining balances.

Going home, Suzanne and Jim didn't have any forms to fill out, and they didn't have to visit any other offices. They had some information to read, and occasionally Jim will call one of the national 800 or local telephone numbers to clarify a question about his benefits. They may use a kiosk in the neighborhood library-it is accessible for the disabled—that provides information on special needs and local jobs. Suzanne also has heard of interactive television that uses the home television to provide the same information as local kiosks. People also can take classes through such interactive TV services.

The social workers at the one-stop office believe that their services really help people like Suzanne and Jim to work through their difficulties. They also feel that the Federal Government saves money for everyone by helping people where it makes the most difference, avoiding higher costs later, and reducing waste and fraud. The change was not easy, however; "it's like starting over."

Working Together

The next story is about a suburban minority businessman who is using a computer in his tool design shop to do business with the Federal Government. He is using electronic data interchange (EDI) to exchange important information and network with fellow minority businesspeople around the Nation, He hopes to send designs to his clients using the so-called broadband capacity that he can access from his shop,

Daniel has never met most of his colleagues—at least not in the traditional sense. They have helped make his minority business profitable by doing business and exchanging ideas purely through a computer network. His network partners and colleagues live and work all over the country.

He initially bought the computer to do business electronically. All the invoices, bills, and payments are now handled by either the main computer or the backup. Daniel was reluctant at first-he didn't know anything about "electronic data interchange," and he thought it would be expensive. Once he got the contract with the Federal Government, however, he found he could write off much of the cost of the computer and the soft ware. Now he can use it with his other customers too, since it uses the international standard format. Because it is an open system, he can purchase or upgrade whatever equipment and software he chooses, provided it supports the standard format.

"It works like this," he says. "The government keeps its inventory records on its computer. When the inventory of an item is too low, its computer automatically sends my computer a message. When the order is ready to ship, my computer sends a bill back on a toll-free number. After a pre-arranged period, the government computer automatically transfers a payment to my business bank account, and my computer gets a message from them and my bank."

More Efficient Government

The government saves money too because there are fewer errors and inventory is better controlled. The government doesn't only *use* computers; the computers are actually *integrated* with its business partners, public assistance programs, and health care providers. Now Daniel can send in his regulatory, tax, minority business, and other Federal forms using the same system he uses for electronic commerce at no extra cost.

Daniel also sends many of his questions by e-mail directly to the agency: "Who has the time or money to call, only to get a busy signal, be put on hold, or find no one is there because of the difference in time zones?" he asks. "With this e-mail system, when I have a question, I put it out

to the agency contact. The contact responds when he or she has a chance to."

Today, it's the only way he can run his business, since his competitors—many of them big companies—are also using this "electronic commerce." "I didn't learn any of this in technical school, except for some basics in computers, and that was a long time ago," he continues. Computers have come a long way since he was in school. Now he does everything just by using an electronic pen—point and click. Well, almost everything. The government requires tight security on many of the transactions; many require his smart card, which he keeps with him, and he has to type in a password and use encryption. For every transaction, his computer also receives a confirmation that the message was received without any errors.

Networking With Colleagues

The electronic commerce application led Daniel to the minority business network, organized by individuals but with on-line assistance from Federal agencies and financial assistance from the Corporation for Public Networking. Other businessmen and women send electronic mail and post to an electronic bulletin board to help each other. For example, when Daniel started plans for a new product, he didn't know how to deal with the forms and regulations for the Department of Labor. He put out an e-mail message asking for help, and someone suggested that he order a CD-ROM on toxic chemicals, which he did. He received names of people in his area who could help him with legal matters. Now he is one of the more experienced contributors, and he helps the newcomers to the system.

Using Broadband Services

Daniel also purchased software to do tool designs on the computer, and sent the designs to the customer's computer over the telephone system. He hopes to expand his business across the country, even overseas, With the new design business, Daniel can use some of the "broadband" telecommunications capacity that he can access from his business. The broadband system sends video and data back and forth between computers very quickly over fiber, copper, or coaxial cable, or via radio.

His daughter also uses broadband. Her teacher can arrange collaborative projects with other classes all over the world, or call up interactive programs from Federal agencies such as NASA. Daniel is more excited about the software that his daughter is using in her design class, however. "The software is now inexpensive enough that my daughter can use this stuff in school," he says. "At least the software companies are finally writing creative software for schools. They realized that there is a big market there if the price is right—and of course there were some government partnerships along the way."

Rural but Not Remote

The final story is about a retired woman who uses on-line systems and CD-ROMs to keep her rural community involved with government. She also has been a patient at the local health clinic where she was treated in part by means of telemedicine. These systems, and another delivering distance education at a local Native American tribal college, all use a technology called narrowband ISDN.

Evelyn says she's always been active, but it used to be with her family or work. Now that she's retired, she's active in her rural community. "Those of us out here far from the majorities need to listen and be listened to-if it's really a democracy, that is," she says. Washington, DC is far away—the local wags say it should be as far away as possible—but even the State capital seems to forget them. As Evelyn says, "If you take all the rural citizens in this country, we add up, and we can help with a lot of the Nation's problems. But rural citizens are not centralized, we're distributed, and that's why distributed communications and government services allow us to participate."

Today she is on-line, scanning recent legislation introduced in Congress and in the State legislature. She calls up the bill on rural schools. She points to an icon, and the full text of the bill

Compact optical disk reader at the Elmer R. Rasmuson Library on the campus of the University of Alaska at Fairbanks. CD-ROM technology is widely used in university libraries across the country.

appears on the screen. "They amended it," she says to herself, and makes a note to call some of her neighbors. She opens a government directory to search for grants on rural development and information from the Consumer Information Center. She learned to use the networks mostly on her own, since they are now much more user-friendly. She also got help from the librarians in town and from other people on the network, including network assistants at all levels of government. Now she often helps the others.

Evelyn also relies on the newspaper and the television, especially the public television channels that broadcast some of the hearings in Congress and in the State Government. She has a fax machine and occasionally sends faxes to the State capital. Yesterday she went into town to the library, and used a CD-ROM from the Department of Education that provides statistics on rural schools. She's used those CD-ROMs at the library a lot to support the community's position. "Some of the CD-ROM information is also on-line on the Internet, a vast computer network," she says, "but the CD-ROM is cheaper and simpler for me if I'm just looking for statistic s."

Using Telemedicine

Evelyn is recovering from a joint ailment that flared up several months ago. Some tests were performed in the local clinic, but one test had to be analyzed by a specialist upstate. Using telemedicine, the clinic sent the data by computer to the upstate hospital, and later the specialist talked to Evelyn and the clinic doctor via a video link. For today's visit, Evelyn will describe how the joint is recovering to both the local doctor and to the specialist upstate watching the live video.

The telemedicine system uses the same ISDN communication that Evelyn uses at home to get her on-line information about Congress. The nurse explains that ISDN is digital and can mix video, data, and voice—something they couldn't do with a single analog telephone line, even though ISDN uses the same pair of wires. "There are a lot of other fancy services out there," the nurse says, "but we can't wait for fiber optics. When we had the opportunity for the pilot project in the mid- 1990s, ISDN became affordable and available, and we took advantage of it."

The clinic is the Native American Health Clinic on the reservation. Evelyn doesn't actually live on the reservation, but the clinic is open to residents in the county, including non-Native Americans. Keeping the benefits straight was a chore at first. There are Native Americans from different tribes, other county residents, and all kinds of benefit plans. Now each individual uses a smart card that incorporates all of the plans, The people at the clinic got the idea, and everyone—the Federal, State, and county governments and the tribal leaders-cooperated to initiate a pilot project. They

have since modified the system a bit to meet the national technical standards that started to form.

Distance **Education**

Telemedicine is not the only such partnership on the reservation. The Tribal College has a video-conference room that also uses ISDN transmission for all sorts of training sessions. Students attend classes that the college televises from the other side of the State, and students from high schools on and off the reservation occasional] y come in for special programs. Federal, State, and county workers also gather for training sessions from the Departments of Agriculture and the Interior. Evelyn goes there occasionally with others for audio-conference meetings with her Congresswoman.

Although equipment is much cheaper today than it was in the 1990s, the cost nevertheless adds up, and any way that they can leverage their tight budget is better for everyone. One big advantage was that the Tribal College could get discount rates for the long-distance teleconferencing using the Federal Government's long-distance contract. It's not a subsidy or free service; they simply pay for long-distance service at the Federal Government rate, which is much better than they could bargain for on their own. "I like the way the Federal Government is doing this," one professor says, "and I don' t usually say that. They coordinate and they are partners, but they don' t mandate from Washington how we should run things here."

Many in the county feel that the new distributed networks, and the new distributed form of government services, are ideal for their rural community; they help them keep up with urban areas and high technology States. "The change was inevitable," Evelyn says, "but getting government to think in terms of a big, open, distributed system was the hard part-that took leadership. We citizens can do the rest."

POINTS OF ACCESS FOR SERVICE DELIVERY

The previous section speculates about what government service delivery could be like in the future. This section describes six "points of access" where citizens might obtain these and other electronic government services. It also discusses the technologies, trends, and issues related to these access points. The six categories outlined here offer many choices: citizens can receive services at home by telephone or computer, in a local library or service center, or perhaps via a local kiosk in a shopping mall, to name a few possibilities. The points of access also reach different types of citizens-individuals, businesses, the disadvantaged, students and teachers, librarians and researchers, community public interest groups, and others. These categories are not intended to be exclusive; in fact, overlapping approaches are often preferable to one single approach, and often can be sponsored through partnerships. Also, some of the specific technologies apply to more than one category.

Homes and Offices

The most convenient and equitable point of access for electronic service delivery would be the home, workplace, school, or local library using technologies such as the telephone or computer (see table 2-1). Home delivery often allows access 24 hours a day and on weekends, and particularly helps Americans who are less mobile due to disabilities, the need to care for dependents, or long distances required to travel to a government office. Distributed service delivery also might help to reduce pollution and traffic, and could encourage telecommuting from home or a neighborhood telecommuting center.] Rural electronic networks could provide on-line government information and distance learning for students, and teachers in

[1] For **telework** examples and issues, see Jack M. Nines, "Energy/Environmental Impacts of Electronic Service Delivery: Trends and Innovations," contractor **report** prepared for the Office of Technology Assessment, November 1991. See also Alan Porter and Scott Cunningham, "Appendix A: A Forecast and Assessment of **Telework,"** in "Private Sector Innovations in Electronic Service Delivery," contractor **report** prepared for the Office of Technology Assessment, January 1992.

Table 2-1—Home and Office Technologies or Services: Key Characteristics and Selected Applications

Technology or service	Key characteristics	Selected applications
1-800 and 1-900 numbers; voice mail; audiotext; automatic call management; etc.	User-friendly if well designed; very accessible and convenient; some require a touch-tone telephone, others respond to voice inputs; can save money, but often in place of service; expert systems require extensive development; many are not TDD-compatible	IRS's "Teletax" services, SSA's teleservice centers, INS's" Ask Immigration"
Facsimile (fax)	Can submit or receive forms 24 hours a day, but requires access to fax machine; more user-friendly and common than computers; ISDN can speed transmission; fax/modems allow computers to directly send to and receive from fax machines	DOC's EBB/FAX, NIH's "CancerFax," Californians "Taxfax"
Dial-up services: Electronic bulletin board services, electronic mail (e-mail)	Can send and retrieve information 24 hours a day, but citizen must have access to computer or terminal with a modem; good for timely information if properly updated; information limited to text; cannot be searched; cost depends on distance and registration fees: user interfaces are not standardized	NTIS's "FedWorld"; SBA's "SBA on-line"; White House's e-mail address; IRS'S electronic tax filing
Internet and other network services: BBSs, e-mail, databases	Similar to above, but require Internet access; cost depends on distance to Internet node and channel capacity	FDA's BBS, NASA and NOAA databases, Project Hermes Supreme Court decisions
Interactive multimedia	Still in development; demand greatest in offices, schools, etc.	USGS's Joint Education Initiative (JEI)
CD-ROM	Optical storage; lightweight and easier to search than paper; good for information that does not change frequently; dimensions and format fully standard; requires CD-ROM drive and personal computer; stores 680 Mbytes	National Trade Data Bank and census data, GPO's U.S. Code and Congressional Record, EPA's Toxic Chemical Release Inventory, journals, and newspapers
Floppy disk (diskette)	Magnetic storage; lightweight and inexpensive like CD-ROMs, but are rewritable, contain less data (2 Mbytes), and the drives are more common; disks can be damaged by dust or magnetic fields	USDA'S Asian trade information, NLM's Grateful MED software, GPO's Medicare pricing table
Television, videotape, radio, print, postal	Timely; far-reaching; serve many languages; widespread use; closed captions exist for hearing-impaired: videotape allows citizen to view when convenient; interactive TV may provide on-line or kiosk features without a personal computer	Emergency services, C-SPAN, education channels, talk shows, newspapers

These technologies are also available in some schools, libraries, and other similar locations

KEY BBS= bulletin board system; CD-ROM= compact disc, read-only memory: DOC=Department of Commerce, EBB/FAX= Electronic Bulletin BoardTax, EPA= Environmental Protection Agency; FDA=Food and Drug Administration; GPO=U S Government Printing Off Ice INS=Immigration and Naturalization Service; IRS= Internal Revenue Service; I. SDN=Integrated Services Digital Network, Mbytes= megabytes, NASA= National Aeronautics and Space Administration; NIH=National Institutes of Health, NLM=National Library of Medicine; NOAA= National Oceanic and Atmospheric Administration; NTIS= National Technical Information Service, SBA=Small Business Administration; SSA=Social Security Administration; TDD=Telecommunications Device for the Deaf, USDA= U S Department of Agriculture; USGS=U S Geological Survey

SOURCE Off Ice of Technology Assessment, 1993

different towns could share information on electronic bulletin boards.[2] Telephone, facsimile, electronic mail, and postal services also can be used to inform government decisionmakers of citizens' interests.[3] Likewise, television, radio, press, and on-line services inform citizens about government decisions.[4]

Even simple on-line computer services and CD-ROMS favor owners of personal computers, however, compared to convenient and equitable toll-free telephone services, mass media, and postal services. Only 17 percent of households own personal computers; only a fraction of those have modems for on-line services, although these numbers should grows On-line services could bypass those who are not computer literate or who cannot afford computers; the government might therefore need to provide similar services via government offices, electronic kiosks, mobile outreach, or community gatekeepers who, in turn, directly help individuals.

Telephone and Fax Services

Telephone services offer great convenience, flexibility, and cost savings if properly implemented. They include a variety of services provided by attendants and recordings, such as using touchtone input to call up information on the attendant's computer screen before he or she comes on the line, or facsimile (fax) services integrated with computers. If poorly designed or if undue emphasis is placed on cost savings only, however, telephone services can produce long waiting times, inaccurate responses, unwanted voice mail recordings, and other frustrations, Toll (1-800) charges can also be very expensive for the government; 1-900 numbers can recover these costs for certain transactions, but put higher costs on the citizen. Government agencies have only recently enhanced some services to make them accessible to users of TDD (Telecommunications Devices for the Deaf). About 94 percent of U.S. households have telephone service, but not all have touchtone service (although most have touchtone service available).

Mass Media

Mass media services are particularly important because they are already in widespread use: televisions are present in over 96 percent of U.S. households, and videotape players in 72 percent.[6] Cable services promise to be more interactive in the future, possibly allowing on-line computer services through the television set. About 61 percent of households subscribe to basic cable television service and 97 percent can choose to.[7] Citizens who do not have televisions, however, may be particularly isolated, disenfranchised, or disadvantaged and in need of government services.

The mass media can also "legitimate" government services for citizens—particularly isolated

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[2] See U.S. Congress, Office of Technology Assessment, *Rural America at the Crossroads: Networking for the Future, OTA-TCT-472* (Washington, DC: U.S. Government Printing Office, April 1991); and *Linking for Learning: A New Course for Education,* OTA-SET-430 (Washington, DC: U.S. Government Printing Office, November 1989).

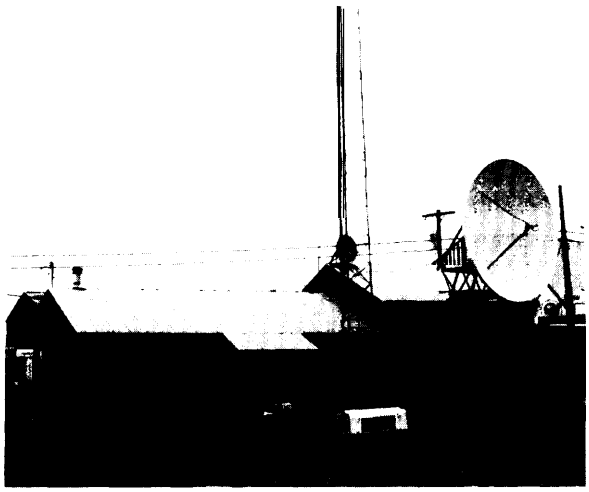
[3] Telephone lines and r[illegible] are heavily used to register opinions at the White House and in congress. In the first eight days of the 103rd Congress, the congressional switchboard received over 1.6 million calls. In January 1993, the White House announced a public e-mail address in addition to the existing public telephone number and postal address. The computer memory was soon filled to capacity as citizens sent e-mail from all over the country. As of March 1993, the computer was receiving an average of 700 messages per day.

[4] The Library of Congress recently made some congressional information available on-line, although full text Of legislation or hearing schedules are not available. See Stephen Frantzich, Congressional Data Associates, "Electronic Service Delivery and Congress," contractor report prepared for the Office of Technology Assessment, November 1992. The Government Printing Office Electronic Information Access Enhancement Act of 1993, Public Law 103-40, directs GPO to set up an on-line system for distributing the *Congressional Record* and the *Federal Register* to the public.

[5] U.S. Congress, Office of Technology Assessment, *Adult Literacy and New Technologies: Tools for a Lifetime,* OTA-SET-550 (Washington, DC: U.S. Government Printing Office, July 1993).

[6] Ibid.

[7] Dr. Richard R. Green, Cable Television Laboratories, Inc., written testimony at a hearing before the House Committee on Science, Space, and Technology, Subcommittee on Technology, Environment, and Aviation, Mar. 23, 1993. The data are from A.C. Nielson Co. and Paul Kagan Associates, Inc.



KOTZ-TV in Kotzebue, Alaska, 30 miles above the Arctic Circle. Broadcast and cable television stations in remote areas heavily depend on satellite transmissions to receive programming.

or ethnic populations—in ways that kiosks or service centers cannot. These media act as local partners in delivering information about government services to community leaders. For example, a Native American television station in rural Montana or a Korean newspaper in downtown Los Angeles is often more effective in delivering information about services than the government acting alone.

Bulletin Boards and Computer Networks

Electronic bulletin board systems allow citizens to browse computer menus, files, electronic mail, on-line conferences, or complete on-line forms and transactions via a dial-up telephone call or a nationwide computer network, such as the Internet. Bulletin boards are easy to set up with personal computer equipment and telephone lines, but their contents must be kept current to maintain interest. Bulletin board systems also do not use standard user interfaces.

The 175 or more publicly available Federal bulletin boards[8] often are hard to find. Since early 1993, the National Technical Information Service (NTIS) has operated FedWorld, a bulletin board that, in turn, provides access to over 100 other government bulletin boards. The U.S. Government Printing Office (GPO) maintains the Federal Bulletin Board—a central source for publications and notices from several government agencies.

Government bulletin boards are either free or charge nominal fees;[9] some require registration and a password. Files can be large, however, and the user may have to pay for an expensive long-distance call while the file is transferred (unless the information is provided to a local bulletin board). These long-distance charges can be prohibitive for man y citizens. The government could provide toll-free access to government dial-up and Internet services, similar to 1-800 telephone services, to reduce these "metered" communications charges for citizens.

The Internet is a giant computer network woven together from many smaller networks and accessible through commercial and noncommercial providers (see ch. 3). Growth in the number of users has been phenomenal; it currently includes over 100 Federal Government networks of varying sizes, but there is no directory for the government services provided on these networks. More user--friendly applications and interfaces are needed to make the Internet more personal and accessible to those who lack sophisticated computer skills. The government could even provide e-mail attendants or librarians on-line, similar to the attendants used for voice calls. The attendants could respond to questions by e-mail, or by telephone if necessary, to direct the citizen through the network; help with difficult computer instructions; or simply answer questions that bulletin boards and other services do not. E-mail systems could quickly overload the

[8] Charles R. McClure, Rolf T. Wigand, John Carlo Bertot, Mary McKenna, William E. Moen, Joe Ryan, and Stacy B. Veeder, "Federal Information Policy and Management for Electronic Service Delivery," contractor report prepared for the Office of Technology Assessment, December *1992*, p. 38. There were an estimated 30,000 public bulletin boards in the United States in *1990*, and perhaps over 60,000 in 1993.

[9] For example, the Department of Commerce's Economic Bulletin Board costs users $35 per year plus per-minute charges, and receives over 10,000 calls per month.

government, however, if installed without thought to the implications for agency workloads.[10]

Compact Optical Disks

CD-ROMs[11] are particularly effective for reference materials and searchable databases that can be updated monthly or over longer periods. They are lightweight compared to an equivalent paper document, can be delivered by mail, and often cost $30 per disk or less--over 150 times less per byte than paper. One CD-ROM contains, and can search in seconds, over 5 billion bits of data, the equivalent of an encyclopedia;[12] over 100 full screens of high definition digital images; or a full movie if compressed and shown on a small part of the screen. The CD-ROM industry is highly standardized for physical dimensions and formatting. Table 2-2 shows the time required to transmit the amount of data that can be stored on a CD-ROM using several transmission services.

The government should continue to use CD-ROMs to reduce costs.[13] Agencies can publish CD-ROMs for as low as $800 per master and $2 to $3 per disk, although the full cost is more typically $15 to $100 per disk when development, processing, software, and other production costs are included. In the United States, of approximately 70 million personal computers in homes and offices, over 1 million have CD-ROM drives. The price of these drives has dropped to about $300 from over $1,000. Although there are many more floppy disk drives, penetration of CD-ROM drives is increasing rapidly, and the CD-ROM drives store much more memory (but are not rewritable). WORM (write-once read-many times) and magneto-optic disks use nonstandard formats and therefore are not suitable for publishing. Many techniques, such as animation, exist to implement multimedia using CD-ROMs; no standards have

Table 2-2—Time Required To Transmit Data on CD-ROM

Type of telecommunication service	Rate (bits per second)	Approximate time required
1,200 bps modem	1,200	2 months
9,600 bps modem	9,600	1 week
ISDN	64,000	1 day
T1	1.544 million	1 hour
T3	45 million	2 minutes
SONET OC-48	2.488 billion	2 seconds

Time required to transmit the amount of data that can be stored on a CD-ROM using various telecommunication services. The times are rounded to simplify understanding. One CD-ROM per month is equivalent to a "data rate" of about 1,540 bits per second, or roughly the amount of data that can be transmitted over a 1,200 bps modem running 24 hours per day for 2 months ISDN, OC-48, T1, and T3 are commercial transmission services.

KEY: bps=bits per second; ISDN=Integrated Services Digital Network: SONET=Synchronous Optical Network.

SOURCE. Office of Technology Assessment, 1993.

10 The Santa Monica PEN system includes electronic mail and has increased the workload of city staff. The city, nevertheless, feels that electronic mail and on-line discussions allow the city government to hear from a greater diversity of citizens, and have improved city management.

11 CD-ROM stands for compact disk with read-only memory. Musical compact disks, or simply CDs, are also read-only, but the ROM designation implies that the CD-ROM is used with a personal computer. To further complicate terminology, WORM (Write-once read-many times memory) refers to similar technology, but is formatted differently.

12 The *Oxford English Dictionary* is available in 20 paper volumes weighing 137 pounds and costing $2,750, or on one CD-ROM for $875. The CD-ROM can search any of the 615,500 words and 2.4 million quotations in seconds.

13 Agencies share information through the 6,500-member Special Interest Group on CD-ROM Applications and Technology (SIGCAT), sponsored by the U.S. Geological Survey until 1993.

emerged, however, and the government should take a cautious approach to these new developments.

Interactive Multimedia

Advances in personal computers and broadband communications promise more ''interactive multimedia'' applications in homes, schools, and particularly offices. The main technological barriers—the need for audio and video processing in personal computers, development of new applications, and standards to help the industry move ahead smoothly—appear to be surmountable. While these multimedia workstations may have great potential for work, education, audio-visual retrieval in libraries, and so forth, it is unlikely that most citizens will need or be able to afford such advanced services in the home in the near future. Demand will likely grow considerably in the mid- to long-term, however.

Neighborhood Electronic Kiosks

Electronic kiosks are interactive multimedia computer stations placed in central locations, particularly shopping malls or one-stop service centers, libraries, post offices, senior citizens' centers, campuses, public housing complexes, and clinics (see table 2-3), Kiosks can substitute for a trip to a government office, several investigative telephone calls, or transactions by mail, and can be accessed after hours and on weekends. They have preprogrammed video and sound like a television; they are user-friendly and may have a printer like an automated teller machine (ATM); and they have graphics and expert system software like a computer. Usually, the monitor is "interactive"; by touching the TV screen, the user can respond directly and simply to the questions posed by the computer. Some kiosks have a slot that accepts credit cards for fee-based services.

Citizens who have difficulty communicating, or are simply curious, may find that requesting information from a kiosk is friendlier than over the telephone or in person. People can browse at any pace or several times if necessary. Many citizens have said they are more comfortable providing personal information to a computer than to a public employee, and feel that the computer treats them more fairly and consistently. Kiosks often provide information in several languages; in Hawaii, for example, the Hawaii Access project operates in English, Samoan, and Ilocano. People also can avoid long waits in line for government services; almost 60 percent of 60,000 queries in the initial State of California InfoCalifornia kiosk pilot program were made after normal working hours or on weekends.

Table 2-3—Types of Electronic Kiosks: Key Characteristics and Selected Applications

Type of kiosk	Key characteristics	Selected applications
Off-line, Stand-alone	For information that does not need updating; no telecommunications costs	GSA's Central Office Building directory
Off-line. Polled	Can update Information, and retrieve queries and survey results over a telephone line and modem at night	USPS's "Postal Buddy"; "24-Hour City Hall"
On-line	Can process information immediately; can update rules and software in central computer; requires dedicated telephone line and central computer capacity.	Tulare County, CA's "Tulare Touch"; State of California's "Info California"
On-line Transactional	On-line, but can also collect money via credit or debit cards for bills and services	Long Beach, CA's "Auto Clerk"; State of California's "InfoCalifornia"

KEY GSA= General Services Administration; USPS=U S Postal Service

SOURCE: Office of Technology Assessment, 1993

An important inhibitor is the initial cost required for kiosks. Kiosks used in pilot projects typically cost from $15,000 to $25,000, including hardware, software, and a vandal-proof enclosure. Application development for a kiosk project could cost an additional $50,000 to $200,000 or more. This cost includes customizing the software for the specific application and making video segments for a laser disk. Different agencies and levels of government should share kiosks, therefore, to reduce costs, for the convenience of the citizens, and to avoid competing for space in central areas.

Sometimes costs can be recovered through reduced demands on government staff, however. The Long Beach, CA Auto Clerk system cost about $500,000 and is expected to pay for itself in 2 to 5 years. The U.S. Postal Service estimates that 10,000 proposed "Postal Buddy" kiosks could save $35 million to $50 million on its 42 million address changes each year. The Tulare County, CA "Tulare Touch" cost $3.2 million for 30 kiosks in 6 welfare offices (the kiosks themselves are $15,000 each, plus development costs), and is expected to save at least $1 million per year.[14] Besides reducing staff costs, savings also accrue through reduced errors and improved employee productivity.[15] Reducing routine tasks for agency staff also frees up time to address problems that require special attention.

Critics claim that kiosks often do not fill a significant demand and that frequently the information they provide is not kept current. Some feel that kiosk applications that do not clearly reduce government expenses are not justifiable. Kiosk designs may also exclude visually impaired or deaf citizens, or those who use wheelchairs; thorough planning and standards are needed to ensure that kiosks are designed to meet the needs of most potential users.

Another inhibitor is that kiosks are not standardized, making it difficult for Federal agencies to share kiosks. State and local governments increasingly are using kiosks to combine services,[16] but use different designs and do not all accept information in the same format. The Federal Government could provide information to these State and local kiosks in a common or standard format, similar to providing CD-ROMs in a standard format suitable for libraries. Federal agencies could distribute these standard packages at cost through NTIS, GPO, or another agency. Commercial vendors may be in the best position to standardize the kiosk operating systems, since the industry is developing quickly. The government could collaborate with industry in developing a standard format through the National Institute of Standards and Technology (NIST) or an interagency committee.

Instead of multipurpose kiosks, businesses and the Federal Government are testing kiosks for specific niche applications. The U.S. Postal Service's "Postal Buddy" makes address changes, dispenses stamps, and provides other postal services. The Department of Veterans Affairs and the Social Security Administration are pilot-testing kiosks for service delivery, and are collaborating with the Postal Service on a multiagency kiosk. The success of such Federal kiosk programs is unclear.

Community One-Stop Service Centers

The One-Stop Concept

In many cases, the Federal Government could consolidate its service delivery into centers shared

14 The savings in staff time are considerable. The kiosks currently process 83 percent of their 45,000 Aid to Families with Dependent Children (AFDC) cases and 16,000 food stamp cases, and the county intends to add 30,000 MediCal cases to the system. The county receives 250 to 350 applications per day, with each application requiring from 15 minutes to 2 hours of staff time.

15 For example, although error rates are difficult to quantify, the Tulare Touch staff found that the error rate from Staff processing On welfare submissions dropped from 38 percent before using kiosks to zero after kiosks, based on 200 cases tested with each system. Tulare Touch is also credited with reducing staff turnover from 37 percent to 12 percent.

16 Public Technology, Inc. has helped to implement several "24-Hour City Hall" projects in partnership with IBM. Examples include the Phoenix, AZ "Phoenix at Your Fingertips," and the Kansas City, MO "City Hall in the Mall." Public Technology, Inc. is a nonprofit arm of the National League of Cities, the International City-County Management Association, and the National Association of Counties.

by related agencies, including State and local government agencies.[17] In this way, agencies could share expensive technology not otherwise affordable, and gain synergy from improved cooperation (see table 2-4). For the recipient, such centers save effort, reduce the "run-around," and provide more complete, better quality services. The service center could be in a Federal building, city hall, or other convenient location as space and budget allow. Agencies can fully colocate their offices, simply send representatives to an appropriate location to help the public directly, or have a "virtual" one-stop center using desktop conferencing.

The main concept behind the one-stop service center is not technological, but one of public administration—it makes government more human and personal. Considerate, human contact between agency representatives and citizens is very important. If one agency cannot help a citizen, the employee can direct the citizen to the appropriate agency "down the hall." Agencies working together can avoid traps that catch unwary citizens who do not receive appropriate assistance. Hillsborough County, FL; Boston, MA; and the State of Delaware have established one-stop shopping methods for medical care.[18] Similar coordination is the aim of the Department of Agriculture's "Infoshare" program. The City of Everett, WA, placed an office in a shopping mall ("City Hall at the Mall") for citizens to pay bills

Table 2-4—One-Stop Service Center[a] Technologies: Key Characteristics

Technology	Key characteristics
Audio conferencing	Simple: relatively inexpensive; sufficient when no data or graphics are presented
Room-scale videoconferencing wideband	Full-motion analog (6 MHz) one-way or two-way transmission best for one-to-many applications like distance education: two-way transmission cost is decreasing, but is still expensive for small groups due to setup cost
Room-scale videoconferencing compressed	Uses compression algorithms to reduce video bandwidth to 64 to 768 kbps depending on application; transmission is one-to-one, one-to-many, many-to-many, audio may not be synchronous; good for distance education or meetings, users include Congress, EPA, GSA, DoD; equipment costs about $30,000 to $60,000 per location, and cost is decreasing
Desktop text- and videoconferencing and multimedia	Combine personal computers and video compression; bandwidth can be reduced to 64 or 128 kbps using ISDN or LANs; excellent for text-conferencing, video image is small and jerky; equipment costs about $5000 per location and is decreasing
GIS telephone systems, etc.	Agencies can consolidate and share equipment such as GIS, PBX telephone-switching equipment, or FTS2000 capacity
Kiosks	Can process citizen inquiries
CD-ROMs on-line services, etc.	Provide access for those who do not have personal computers; may require attendant to help users

[a] The one stop center here is not synonymous with a kiosk, the center may or may not include a kiosk

KEY: CD-ROM= compact disk, read only memory; DoD=Department of Defense, EPA= Environmental Protection Agency, FTS2000=the Federal long-distance telecommunications program; GIS=Geographical Information Systems, GSA= General Services Administration; ISDN=Integrated Services Digital Network, kbps=kilobits per second, LANs=local area networks, MHz=megahertz; PBX=public branch exchange

SOURCE: Office of Technology Assessment, 1993

[17] Some people refer to electronic kiosk.. as one-stop centers, but a distinction is made in this report. Here, a one-stop service center might include a kiosk as part of its services.

[18] National Commission t. Prevent Infant Mortality, "One-Stop Shopping for infants and pregnant Women," *Public Welfare, vol. 50, No. 1,* winter 1992, p. 26.

and carry out other transactions.[19] Several other countries have various degrees of one-stop centers in place, including Canada's InfoCentres and Business Service Centres, Denmark's "electronic cottages," and France's "single window" project.[20]

In addition to office expenses and videoconferencing costs, agencies also could share costs for upgrades to local telecommunications equipment such as PBX switches, or geographic information systems (GIS) for resource management and other uses. Agencies also could consolidate or upgrade telecommunications channels to reduce total costs.

Room-Scale Videoconferencing

Room-scale videoconferencing favors sites where there are many people or many different agencies or functions, as opposed to a small office with a single function. For example, a conferencing room could be used for military reserve training on weekends, distance education for local citizens during weekday evenings, and employee training or meetings during working hours. Public health clinics could use it for telemedicine, or law enforcement officers for remote arraignment procedures. Congress has used videoconferencing in some pilot hearings and town hall meetings.[21,22,23] The conferencing industry is growing at the rate of several thousand new installations per year; some corporations have dozens of sites. At the end of 1991, over 5,000 videoconferencing rooms were in active use in North America.

Videoconferencing saves direct travel expenses, improves productivity, and eliminates traveling time. Travel is often still important, however, to truly understand another's environment and to get out of one's own. Videoconferencing also requires new communication skills and has some drawbacks. For example, automatic camera operation can be distracting for the viewer, hearing can be difficult, first-time participants are often uncomfortable, and groups can appear disorganized.

Desktop Conferencing and interactive Multimedia

Desktop conferencing is the less expensive personal computing version of text- and videoconferencing limited to two or three people at a time—more or less "one-t o-one." More important and less expensive than the video are its text- and audio-conferencing features, That is, two people in different offices can work on the same text or graphics simultaneously using computers linked together through local area networks (LANs). Store-and-forward technology may even one day allow people to exchange videoconferences and text files like electronic mail. Similar to electronic kiosks but more flexible, desktop videoconferencing is part of "interactive multimedia"[24]—the integration of sound, text, compressed video, and graphics in one terminal, using inputs from the user. This technology is advancing quickly, and is only limited by the development of standards and new applications.

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19 The city noted that voter registration rates were almost four times higher after the field office was opened. See Eben Shapiro, "Even City Hall Has Moved to the Mall," *New York Times*, July 30, 1992, p. D1.

20 See "Administration as Service: The Public as Client," *OECD Observer*, June 1987, p. 10, and other studies by the Organization of Economic Cooperation and Development (OECD).

21 The U.S. House of Representatives has equipped six hearing rooms with cable for videoconferencing, and has conducted several hearings using videoconferencing. Its real value may be to receive more testimony from individuals "outside the Beltway." U.S. Congress, House Committee on Science, Space, and Technology, "Video Teleconferencing, A Congressional Demonstration Project," forthcoming. Also see Fred B. Wood, Vary T. Coates, Robert L. Chartrand, and Richard F. Ericson, "Videoconferencing Via Satellite: Opening Congress to the People," the George Washington University Program of Policy Studies in Science and Technology, April 1979.

22 Agencies share infmation and promote standardization of equipment through the Video Conferencing Working Group under the Interagency Information Resources Management Infrastructure Task Group.

23 The General Accounting Office found, in a (j-month pilot test, that videoconferencing was very effective, and saved $31,000 in travel expenses alone by eliminating 39 trips between Seattle, WA and Washington, DC. See U.S. Congress, General Accounting Office, *Vi&o Teleconferencing-GAO's Pilot Test*, GAO/OIMC-92-1 (Gaithersburg, MD: U.S. General Accounting Office, December 1991).

24 See the March 1993 issue of *IEEE Spectrum* and the May 1992 issue of *IEEE Communications Magazine* for a discussion of multimedia.

Doctors already use such multimedia workstations with large high-definition monitors to diagnose patients in distant hospitals or to receive medical records. Employees and citizens could use multimedia desktop conferencing for distance education and training, or for viewing library documents.[25] Government employees could use conferencing for small meetings between regional offices instead of traveling, telephoning, or using electronic mail. In the future, government and other telecommuters could use desktop conferencing to create a "virtual office" at home; that is, they can contact co-workers and work together as if they were in the same office.

Agencies could use desktop conferencing to form a "virtual one-stop service center" if they cannot physically colocate. That is, when a citizen visits one office, the agency representative could contact other Federal, State, or local workers through a desktop conference to consult or save the person a trip. A telephone conference call could also be used, but the desktop conference would be more personal and engaging because the participants actually see one another. In addition, text or forms can be exchanged electronically, as can be done using the U.S. Public Health Service's "Community Services Network" pilot project.

Coordination and Logistics

The primary inhibitor of the one-stop service center is the cooperation it requires among traditionally competing agencies; it is a striking example of the importance of Federal-State-local partnerships. A one-stop center requires careful planning, teamwork, cross-training, and joint management.[26] Planners must assess the needs of the particular community. One-stop shopping will not always work for many rural Americans, non-English speakers, the homeless, illiterate Americans, children in need, and so forth because they are unaware of the services provided, disenfranchised, too remote, or too busy to participate.[27]

Another inhibitor is simply logistics. Centralized office space is a good idea, but often is not available or affordable. Long-term leases expire at irregular intervals; moving costs can be high. While many citizens may find the new service center simpler and more convenient, others may have to travel further for a particular service. As an intermediate step, agencies could send representatives periodically or full-time to a central point to help the public and work with other agencies, or create the "virtual one-stop centers" described above.

Mobile Access

A number of technologies could provide mobile access to government services (see table 2-5). For example, Federal workers could be contacted by telephone or computer while out of the office; satellites could deliver distance education to agency staff; and new mobile computer technology could allow workers to process forms and retrieve data without returning to the office. Mobile services are used by emergency and law enforcement officials, but also might be beneficial to human services caseworkers.

A new mobile application might involve a "Service Center on Wheels" or "Mobile One-Stop Service Center" that combines many functions in a truck or van and uses satellite or land-based receiving equipment. Such a mobile service center might include portable or laptop computers with CD-ROM drives, or wireless modem or ISDN communications. Portable electronic kiosks could be installed quickly in emergency situations. The one-stop service center, in partnership with State and local governments, might manage such mobile services.

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25 The Library of Congress in Washington, DC, has a National Demonstration Laboratory that showcases such new technologies. Included is the American Memory Project for electronically disseminating all types of media-first in CD-ROM and liner disks, and later on-line.

26 For example, *see* Marilee C. Rist, "One-Stop Shopping for Student Social Services," *The Education Digest, vol. 58, No.* 1, September 1992, p. 12.

27 Gordon Landes, "A State View of One-Stop Shopping," *Public Welfare*, vol. 50, No. 1, winter *1992,* p. 35.

Table 2-5—Mobile Service Delivery Technologies: Key Characteristics and Selected Applications

Technology	Key characteristics	Selected applications
Cellular telephony and data	Operates in 1-to 50-mile diameter" cells"; currently analog but converting to digital: limited to areas that have transmitters	Case- and field-workers, mobile service centers
Personal communication services (PCSs)	In trial stage; include technologies using microcells and personal communication networks (PCNs)	Office buildings, hospitals, etc., where user density is lame
Portable computers, laptops, electronic notebooks	Allow office to be mobile; new features include modems and CD-ROM readers; some have limited pen-based input: "personal communicators" promise to combine computing with wireless telephone, fax, and data'	Case- and field-workers, mobile service centers
Portable electronic kiosks	Could be deployed in distressed areas to provide information or process applications for services	Emergency services
Transportable earth stations, very small aperture terminals (VSAT)	Satellite dishes for all types of telecommunications (voice, data, and video) in remote or mobile locations where cables or land-based antennas are not effective; very useful for broadcast	Emergency services, mobile service center, distance education, videoconferencing
LEO satellite service	Proposes national or global data and telephone coverage beyond range of terrestrial systems; under development	Case- and field-workers, emergency services, GPS services
GPS receivers	New compact receivers allow placement in small aircraft, boats, cars, and trains; over 1 million commercial users estimated by the year 2000	Navigation, positioning, traffic control

KEY GPS=Global Positioning Satellite; LEO= Low-Earth Orbit

SOURCE: Office of Technology Assessment, 1993

The major strength of mobile service delivery is its outreach capability. A service center on wheels can help those isolated by distance, disabilities, language, education, illness, age, economic level, the need to care for others, or other limitations. As with the fixed service centers, the most important mobile service is a human one, and the technology only helps the worker to perform tasks and extend the office to the field.

Mobile communication[28] includes radio telephones, pagers, cordless telephones for the home, CB radios, private dispatch networks, cellular telephones, air-to-ground telephone services, one-way and two-way satellite services, and the proposed personal communication services (PCS) .29 The Federal Government obtains its mobile communications through both the National Telecommunications and Information Admini-

28 For a study of spectrum allocations, including mobile communications, see U.S. Congress, Office of Technology Assessment, *The* 1992 *WorldAdministrative Radio Conference: Issues for U.S. International Spectrum* Policy, OTA-BP-TCT-76 (Washington, DC: U.S. Government Printing Office, November 1991). See also U.S. Congress, Office of Technology Assessment, *The 1992 World Administrative Radio Conference: Technology and Policy Implications*, OTA-TCT-549 (Washington, DC: U.S. Government Printing Office, May 1993).

29 The family of personal mobile communications is sometimes called Personal Communication Services (PCS), but PCS also refers to a specific frequency allocation for certain new and evolving technologies, including what is sometimes referred to as Personal Communications Networks (PCNs). PCNs would use microcells and digital signaling. The combination of mobile communications, fixed telephones, and intelligent networks suggests a proposed service that assigns an identifier to each user, rather than to each piece of equipment. In principle, one

stration's (NTIA's) allocations (air traffic control, law enforcement, maritime, military, etc.) and through the Federal Communication Commission's (FCC's) allocations to private enterprise.[30] An agency can purchase commercial cellular telephone service in the same way it purchases a fixed telephone line for an office--directly from commercial vendors,

The wider use of cellular telephones for delivering government services is inhibited by uneven and expensive access. Over 90 percent of the U.S. population can access cellular service, but on] y 60 percent of the land area, excluding Alaska, is covered.[31] Many small rural markets with the greatest need for mobile service delivery cannot access cellular service. The proposed low earth orbit (LEO) satellites promise to supplement these holes in land-based cellular service by directly transmitting to and receiving from small handsets. The proposed systems would be very expensive to build, however, and would have to compete with existing cellular systems or generate profits in regions currently considered unprofitable for land-based cellular telephony.[32]

Stores and Banks—Electronic Benefits Transfer (EBT)

What Is EBT?

Electronic benefits transfer (EBT) is defined here as monetary (or in-kind) government benefits delivered electronically directly to the citizen, *or* on behalf of the citizen, through the use of an electronic funds transfer network, point-of-sale (POS) technology, and automated teller machines (ATMs). EBT includes electronic funds transfer (EFT) between banks for direct deposit of Social Security checks. Direct deposit is the least expensive form of benefits transfer,[33] but many recipients do not have bank accounts. EBT also includes cards, similar to bank money cards, which can be used to debit government benefits accounts and therefore can be used to replace paper checks or food stamp coupons. The benefits and costs of EBT are discussed more fully in chapter 4.

The use of cards to deliver benefits reduces human errors, paperwork, and delays. Recipients are identified through the use of passwords and transactions are encrypted, reducing fraud and counterfeiting. Portable and secure off-line cards can also reduce the need for large central on-line databases, such as those containing medical records or benefits.[34] Perhaps most important, serv-

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would call a unique number to locate someone, and the network would automatically track (he person. This proposed integration is known as Universal Personal Telecommunications (UPT), or the personal numbering system, For a review of global and national activity in PCN and PCS, see Bennett A. Kobb, "Personal Wireless," *IEEE Spectrum,* June 1993, and the June and December 1992 issues of *IEEE Communications Magazine.* See also George Brody and Jack Wasserman, "Evolving Voice Technologies for PCS," *Business Communications Review,* April 1992, p. 34.

30 The Cellular Radio Working Group of the Interagency Information Resource Management Infrastructure Task Group acts to share information and evaluate government needs for member agencies.

31 U.S. Congress, Office of Technology Assessment, *The 1992 World Administrative Radio Conference: Technology and Policy Implications,* op. cit., footnote 28, p. 12S,

32 Since cellular telephone conversations sometimes can be overheard by other users, the government's use of commercial cellular telephones requires added security. See Booz-Allen & Hamilton, Inc., "The Implication.. of Digital Cellular Communications for NS/EP [National Security and Emergency Preparedness] Telecommunicate ens," contractor report prepared for the Office of the Manager, National Communications System, May 14, 1992.

33 For example, Fresno County, CA, reported direct *costs* of *12* cents per transaction versus 49 cents per check. Fifty-four Percent of social security recipients current] y receive benefits by direct deposit, See John Harris, Alan F. Westin, and Anne L. Finger, Reference Point Foundation, "Innovations for Federal Service," contractor report prepared for the Office of Technology Assessment, February 1993,

34 A health care card might have several a$_{pp}$l$_{ica}$ti$_{on}$s —[might directly pay for certain services, such as prescription drugs; it might act as a common front-end to many incompatible systems to improve processing, but without completely eliminating paper or on-line verification; or it might contain medical information immediately accessible in case of emergency or as a check against errors when prescribing medications. A primary issue regarding health care applications concerns the privacy of centralized medical records. See U.S. Congress, Office of Technology Assessment, *Privacy Rights in Computerized Medical Information,* forthcoming, See also U.S. Congress, Office of Technology Assessment, *Electronic Record Systems and Individual Privacy,* OTA-CIT-296 (Washington, DC: U.S. Government Printing Office, June 1986).

ice recipients like benefit cards because they eliminate the stigma associated with food stamp coupons or public assistance checks, and they save time.

Types of EBT Cards

Table 2-6 displays basic characteristics of the card technologies; hybrid cards that combine the characteristics of magnetic stripe cards and either integrated circuit or optical cards are also possible.[35,36] In this report, *microprocessor/smart cards* (or simply *smart cards)* are those using integrated circuits with microprocessing capability and some memory. A smart card has an actual computer chip embedded in it, allowing the card itself to make independent calculations. It is literally a portable computer, but the POS terminal provides the power supply, keyboard, and display. Even if an unauthorized user could read the data in the smart-card memory, the data are encrypted and the computer chip itself is virtually impossible to duplicate.

The smart card can be designed so that only the issuer can access some data in its memory (for recordkeeping), only the user for other data (ac-

Table 2-6-Types of Card Technologies: Key Characteristics and Selected Applications

Card type	Key characteristics	Selected applications
Magnetic stripe	Inexpensive ($0,20 to $1 per card); ubiquitous terminals-- good for on-line systems; some are rewritable; small data storage (1 to 7 kbits); easily copied or altered	On-line: bank cards, credit cards, CA driver's license, AR's Medicare card, several food stamp pilots, Off-line: subway farecards
Memory-only (integrated circuit)	Functions like magnetic stripe card but has more memory (100 bits to 64 kbits), is more expensive ($1 to $6 per card), and is more difficult to copy; some are rewritable	Off-line: telephone debit cards; Arlington County, VA's "Parkulator" parking card
Smart (integrated circuit)	Includes computing and encryption-- good for off-line systems; more storage than magnetic stripe card (2 to 8 kbits); is more expensive ($5 to $25 per card): more difficult to copy; rewritable	Off-line: WY's WyoCard for WIC benefits; Montgomery County, OH's food stamp card
Optical	Large data storage (30 Mbits); not rewritable; $5 to $20 per card, but readers are expensive ($1,500 to $4,000 apiece) and require precise and frequent calibration; uses technology similar to CD-ROMs	Reference materials in portable computers, medical records, biometrics
PCMCIA Memory (integrated circuit with connector)	Not practical for EBT; large data storage (20 to 40 Mbits); rewritable; $100 to $650 per card	Backup, add-ens for personal computers

Hybrid cards that combine magnetic stripes with integraled circuit or optical cards are also possible,

KEY AR= Arkansas; CA= California; CD-ROM= compact disc, read-only memory; EBT=electronic benefits transfer; kbits=kilobits; Mbits= megabits; OH= Ohio; PCMCIA= Personal Computer Memory Card Industry Association, VA= Virginia; WIC=Special Supplemental Food Program for Women, Infants, and Children, WY= Wyoming

SOURCE" Office of Technology Assessment, 1993

35 For more information on card technologies and their applications, see Jerome Svigals, *Smart Cards: The New Bank Cards (New* York, *NY:* Macmillan, 1987).

36 EBT is promoted within the Federal Government by the Interagency EBT Steering Committee, co-chaired by the Department of the Treasury and the Department of Agriculture. The Smart Card Users Group is a larger group for sharing information about all types of card technologies.

count balances), only store personnel for other information (transaction data), and perhaps only fourth parties for yet other information (e.g., allergies or drug prescriptions).

The physical layout and many other features of the smart card are standardized. The operating systems and application programs currently are not standardized, but could be soon (or the POS terminals could be designed to read different systems). Then only the smart cards themselves would need to be upgraded whenever new services are added to an existing card,

An *integrated circuit (IC) memory card* (or simply *memory-only card*[37]) has an integrated-circuit chip with more or less memory than a smart card, but without microprocessor capability. This card operates in an on-line system similar to a magnetic stripe card, but it looks exactly like a smart card (and is sometimes called a smart card by vendors). It does not offer the security features of the smart card, nor the low cost or the ubiquitous readers associated with the magnetic stripe card.

The familiar *magnetic stripe cards* used in ATMs and POS terminals are standardized, although more advanced proprietary versions also exist. The terminals are becoming widely available in stores where citizens use their government benefits. Magnetic stripe cards require a password; the stored data are not encrypted, however, and the card is easily duplicated with inexpensive ($50) parts, making it less secure,

Implementation Issues

Besides the different cards, there are also different configurations of EBT systems—fully off-line, polled off-line, on-line to a central computer, selective on-line, on-line to many diverse systems (a common front-end), or selective on-line (see table 2-7). All the cards can function in any of these configurations, but each card has certain strengths and weaknesses depending on the application. The common front-end approach allows art intermediate solution in applications where there are many noninteroperable systems, such as in the health care industry.

Other EBT issues concern overall implementation, rather than selection of a specific card or system (see ch. 4). For example, paper food stamp coupons are costly for States to distribute, stores and banks to handle, and for recipients who must go to the government office and wait in line. EBT may shift more of the relative cost from recipients, stores, and banks to the Federal and State Governments, which in turn affects the overall cost determination. Some of this cost could be shared among these partners, or an EBT system might "piggyback" with the existing banking network of ATMs and POS terminals.

Electronic Commerce and Electronic Data Interchange (EDI)

What Is Electronic Commerce and EDI?

Both electronic commerce and electronic benefits transfer remove the paper from transactions.[38] The difference is that electronic commerce applies to government trade with businesses—perhaps health care providers, contractors, or regulators—whereas EBT applies to monetary public assistance transactions provided to citizens using cards, POS terminals, or ATMs. Electronic commerce and EBT may overlap in many cases; for example, if they are used for both recipients and health care providers in the Medicare program. Electronic commerce may also overlap with other points of access, particularly homes and offices. Table 2-8 shows the components of electronic commerce and their characteristics.

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37 These memory cards should not be confused with PCMCIA memory cards used as add-on hardware or memory backup for personal computers. Such cards correspond to standards devised by the Personal Computer Memory Card Industry Association (PCMCIA) and are not appropriate for EBT.

38 See Benjamin Wright, The *Law of Electronic Commerce: EDI, Fax, and E-mail* (Boston, MA: Little, Brown and CO., 1991), and Benjamin Wright, "Contracts Without Paper," *Technology Review, vol. 95, No. 5,* July 1992, p. 57. See also Eric Arnum, "New Specs, Broader Boundaries for EDI," *Business Communications Review,* February 1993, p. 40; and Michael S. Baum and Henry H. Perritt, Jr., *Electronic Contracting, Publishing, and EDI Law (New* York, NY: Wiley Law Publications, 1991).

Table 2-7—Types of EBT System Configurations: Key Characteristics and Selected Applications

Configuration	Key characteristics	Selected applications
Full off-line	No connections to other computers; no communication or transaction costs	Subway farecards and hotel keys (magnetic stripe), telephone debit cards (memory-only card), biometrics (optical card)
Off-l in- polled	Off-line, but terminal collects transactions for later transmission to central computer; no verification delays; low transmission and transaction costs	Wyoming's WyoCard for WIC benefits (smart card); Dayton, Ohio's food stamps (smart card)
On-line central computer	Decisions made at a central computer; requires continuous or dial-up connection to verify passwords and complete transactions; changes can be up to the minute; favors inexpensive magnetic stripe cards since memory or secure storage is not a factor	Bank cards, Maryland's benefits card, Arkansas' Medicare card
On-line- selective	Routine decisions made off-line, but some decisions made on-line	French bank cards
On-line-independent computers	The "common front end"; allows many diverse systems to read one simplified card to avoid overhauling many systems; added security since there is no central computer or interoperability between systems	Health care providers, interagency or interprogram card-- the card used depends on memory, cost, and security needed

Any of the cards can be used in any of the configurations, but some applications favor certain cards

SOURCE" Office of Technology Assessment, 1993.

EDI refers to the electronic transfer of business information in a standardized electronic form between parties. EDI includes a body of standards and applies to *nonmonetary* transactions. The transfer can involve trading personal computer diskettes by mail, dial-up of a central computer by modem, or direct personal or mainframe computer-to-computer links. EDI is not simply a way of transmitting a paper document via computer. Documents are customized to take advantage of the strengths of the computer and might never be seen by human eyes, although electronic mail or facsimile is often used in lieu of fully computerized transactions.

EDI Costs and Savings

The main strengths of electronic commerce and EDI are improved management and service, and reduced costs and errors for data entry, mailing, and handling and storage of paper. Agencies and vendors can streamline and standardize forms and improve inventory control. Electronic commerce includes "just-in-time" delivery; computers may approve bids and make orders, bills, and payments, all automatically. Cost savings add up; in 1990, EFT cost 4.5 cents per transaction, versus 30.2 cents per paper check.[39] Direct Federal payments of 360 million benefits in 1989 using EFT saved $94 million. The Department of Housing and Urban Development expects to save up to $12 million annually using EDI to process $4.7 billion in mortgage claims.[40] *The* U.S. Customs Service uses electronic declarations for 92 percent of all declarations, 29 percent of which are totally paperless. Forty percent of its $20 billion annual collections are electronic, saving over $500 million annually in transaction and person-

39 Office of Management and Budget, *A Five-Year Plan for Meeting the Automatic Data Processing and Telecommunication Needs of the Federal Government,* (Washington, DC: U.S. Government Printing Office, November 1990), p. 11-21.

40 J&n Moore, "HUD Plans EDI Pilot To Process Mortgages," *Federal Computer Week,* Aug. 24, 1992, p. 1.

Table 2-8—Electronic Commerce Technologies: Key Characteristics and Selected Applications

Technology	Key characteristics	Selected applications
Electronic data interchange (EDI)	Non monetary electronic document transfers using the Xl 2 or UN/EDIFACT standards: some wider definitions include nonstandard or proprietary formats, monetary transactions, or text-based systems such as electronic mail or fax	Invoices, delivery reports, tariff filings, customs declarations, tax forms, insurance claims
Electronic funds transfer (EFT)	Monetary electronic transactions using standards developed in the banking industry	Direct deposits, interbank transfers, ATM transactions
Electronic mail and other ASCII text-based systems	E-mail can transport EDI documents, and internal and business correspondence; text-based systems in general are not designed for computer processing	SEC's EDGAR system
Computer-aided acquisition and logistics systems	Similar to EDI, but used for engineering information that uses computer-aided design	Technical drawings, manuals, engineering data
Universal product codes (bar codes)	Reduce keystrokes and errors: new "portable data files'" store 100 times the bar-code information in a two-dimensional block of dots	Inventory control, delivery documents
Imaging	Digitizes paper documents: advanced imagers can Interpret typewritten and sometimes handwritten messages, relatively expensive	Conversion of mail fax documents, tax forms, and letters
Electronic archiving	Includes storage of all documents in electronic form	All documents and messages
Facsimile (fax)	Does not eliminate paper, but is widely used; high-speed fax requires digital telephone service	Same as for EDI

Some of these technologies overlap, for example Imaging can be used to store fax documents in electronic archives

KEY ATM= Automated Teller Machine; EDGAR= Electronic Data Gathering, Analysis, and Retrieval, SEC= Securities and Exchange Commission

SOURCE Off Ice of Technology Assessment, 1993

nel costs.[41] The Environmental Protection Agency expects to speed up the processing of hazardous waste reports and save $10 million to $15 million per year, with a setup cost of $1 million and operating costs of $5 million to $10 million per year.[42] Widespread use of EDI in the health care industry may save several bill ion dollars annually in annual health insurance administration costs.[43]

EDI is most useful for repetitive and standard transactions; the government will benefit by larger penetration of EDI into its daily business.[44] In practice, EDI is often just another interface to

41 R&~ W. Ehl inger, "U.S. Customs Service and EDI," *EDI World, vol. 2, No. 8,* August 1992, p. 27,

42 Shawn p, McCarthy, "EDI Speeds Up Transfer of Environmental Data," *Government Computer News,* Feb. 1, 1993, p. 54.

43 Workgroup for *Electronic* Data Interchange (WEDI), report to the Secretary of the U.S. Department of Health and Human Services, July 1992, Another study cosponsored by telephone industry companies found that electronic claims-processing alone could save $6 billion in the health care industry. Mark K. Schneider, Nancy Mann, and Arthur Schiller, Arthur D. Little, "Can Telecommunications Help Solve America's Health Care Problems?" July 1992.

44 Over 200,000 government contractors and vendors make 2 1 million transactions annually that are eligible for EDI. Of these, nearly all (over 98 percent) are for amounts less than $25,000.

existing systems-the government (or a large corporation) moves the manual-electronic interface to the businesses with whom it trades. This added interface can be a particular burden for the operators of many small businesses. To help ease this burden, the government could use some of its savings from the use of EDI to subsidize businesses that have no obvious economic incentives to participate in EDI. Businesses also could be encouraged through software discounts, toll-free lines, or special training and assistance.

EDI Integrity and Security

Due to the sensitive nature of business documents, parties sometimes must make agreements in advance regarding the legal validity of electronic documents, what constitutes a "written signature," the length of time required to store documents, and other details traditionally contained in the "fine print."[45] The Office of Management and Budget (OMB) claims that, for government operations, an electronic signature or password is an acceptable substitute for a written signature, provided agencies follow proper administrative procedures.[46-47]

Risk assessment needs to be given a higher priority in EDI systems.[48] The Computer Security Act encourages Federal agencies to conduct risk assessments to help assure that the security is commensurate with the potential harm resulting from the loss, misuse, modification, or unauthorized access to government information.[49] Based on content, documents such as questionnaires may carry a low risk, whereas high-value purchase orders, bids, and tax returns carry a greater risk. Agencies or Federal budget managers too often under-budget for risk assessment, placing electronic documents at risk through loss or leaks of private or proprietary information.

EDI Standards and Telecommunications

The Federal Government has mandated the use of X 12 and UN/EDIFACT standards[50] whenever possible for all EDI transactions, or conversion to them in the near future.[51] Despite some momentum to use these standards, the government uses many proprietary or text-based systems that often require government suppliers or contractors to purchase proprietary software and equipment and use private communication networks. With standard EDI formats, however, suppliers can use the same open systems for other government and nongovernment transactions, to everyone's benefit.

Most EDI transactions require a communications link through a leased or dial-up telephone line or a value-added packet-switching network. The Federal Government's private long-distance services program (ITS 2000) can support some EDI transmission through electronic mail or dial-up and leased lines, but it does not provide full

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45 See, for example, U.S. Department of Justice, Justice Management Division, "Admissibility of Electronically Filed Federal Records as Evidence," *Government Information Quarterly, vol. 9, No. 2, 1992,* p. 155; or Office of Management and Budget, *Information Resources Management Plan of the U.S. Government* (Washington, DC: U.S. Government Printing Office, December 1991), p. 36.

46 See, for example, Peter Weiss, "Security Requirements and Evidentiary Issues in the Interchange of Electronic Documents: Steps Toward Developing a Security Policy," paper presented at the Workshop on Security Procedures for the Interchange of Electronic Documents, National Institute of Standards and Technology, Gaithersburg, MD, Nov. 12-13, 1992.

47 OMB also chairs the Electronic Signature and Messaging Authentication Task Force on electronic signature issues.

48 Julie A. Smith, Logistics Management Institute, "Risk Assessment and Electronic Data Interchange"; and Robert V. Jacobson, "The Need for Risk Analysis"; papers presented at the Workshop on Security Procedures for the Interchange of Electronic Documents, National Institute of Standards and Technology, Gaithersburg, MD, Nov. 12–13, 1992.

49 U.S. Department of Commerce, National Institute of Standards and Technology (NIST), Computer Systems Laboratory Bulletin, "Security Issues in the Use of Electronic Data Interchange," June 1991. See also Computer Security Act of 1987, Public Law 100-235, 40 USC 759.

50 X 12 is a standards committee accredited by the American National Standards Institute (ANSI). UN/EDIFACT is the United Nations EDI for Administration, Commerce, and Transport standard. The X12 standards committee voted that further development of X 12 standards will discontinue in 1997, and new standards will support the international UN/EDIFACT formats.

51 Federal Information *Processing* Standard Publication 161, Electronic Data Interchange, 56 *Federal Register* 13123 (Mar. 29, 1991).

value-added services (see ch. 3).52 Value-added carriers can store and forward messages to other participants, and provide audit trails, postmarking, archiving, retransmission, compliance checking, and other services. Value-added network services are currently procured as a separate contract through the General Services Administration (GSA).

NEED FOR AN ELECTRONIC DELIVERY TECHNOLOGY STRATEGY

OTA found, from its review of the electronic delivery technologies discussed above, that the technologies themselves generally do not limit service delivery. At this time, however, the Federal Government lacks an interagency or national strategy to implement electronic delivery technologies, and needs to develop one to leverage its efforts and to assure that important issues, such as access and privacy, are addressed. Federal, State, and local governments are applying man y of these technologies but are doing so independently, and missing opportunities as a result. Congress and the President could oversee the development of a governmentwide technology strategy for electronic service delivery, with active participation by NIST, GSA, NTIA, and agency representatives, perhaps working through an interagency committee, Such a strategy could be part of the larger service delivery strategy discussed in chapters 1, 5, 6, and 7, and more comprehensive than current Information Resource Management (IRM) or standards-setting efforts.

A technology strategy as discussed here should not be interpreted to mean an overall central plan for all electronic delivery, and is not intended to focus only on the technologies *per se.* It should instead be a framework that allows innovation and partnerships both within and outside government, avoids "reinventing the wheel," and properly applies the technologies to citizen needs, The strategy could include ongoing workshops, conferences, and publications to provide a clearinghouse for Federal agencies and State and local governments to share information and keep up with technology. Users' groups are particularly important to enable agencies to share their experiences.

Leadership

An effective technology strategy would encourage leadership at all levels. In the cases OTA studied, effective leadership was critical to every project-even low-cost and user-friendly technology and the hard work of many dedicated parties were not enough. Leadership includes having a clear vision and commitment; supporting innovation; taking risks where appropriate; understanding citizens' needs; outlining a clear mission and objectives; and fostering teamwork with different agencies, governments, industry, and citizens. Strong, effective leadership helps to overcome inertia to change and encourages innovation at all levels.

Pilot Tests

An effective technology strategy would emphasize pilot tests and partnerships. Pilot projects allow agencies and local governments to innovate, experiment, gain experience, and then apply the appropriate technology. Such experimentation produces more diversity and presents a smaller risk than selecting a single "winning" technology. Systems that work well in one situation may not work in another or may not scale to the Federal level or across agency boundaries. The technologies and standards are also moving and risky targets, and the demand for electronic services is not well known.

Open Systems

An effective government technology strategy would seek to use open systems as the common delivery platform through consensus or by encouraging industry to develop standards, Open systems

52 X.400 electronic mail is used for some EDI transactions over FTS2000. X.435 will eventually replace X.400 for that purpose and will help to standardize some EDI transactions inside the government, but will not provide full value-added services,

are those that use commercially available equipment and software that conform to common interoperable standards, as opposed to proprietary or custom-built systems. Open systems are like open markets; new players can innovate and sell their products, and buyers can use them in existing systems. The common standard could be a de facto standard derived from market preferences or a de jure standard established by a standards committee, although changing and competing standards often make open systems difficult to achieve in practice. If State and local kiosks used common operating systems, the Federal Government could provide standard packages to State and local governments, saving money for all. If the government uses compatible videoconferencing equipment, different agencies could share equipment. Agencies also could share information using common electronic bulletin boards, CD-ROMs, or the Internet instead of creating redundant systems. Future smart cards may also have open operating systems so that developers can sell new applications that operate on the same card, even if the microprocessor is upgraded.

Emphasize the User

An effective technology strategy should also emphasize the human element—the citizen—that is present in every aspect of service delivery. Success is defined by how well a new delivery system meets the needs of users, not by how well the technology functions or meets cost projections. Food stamp recipients like using benefit cards because they remove the stigma of paper coupons. Welfare applicants like the Tulare Touch electronic kiosk because it treats them consistent y and without bias. Teachers in rural schools like computer networks because they can collaborate with other teachers and overcome their isolation, The one-stop service center and mobile services address citizens' needs directly.

People using computer networks at home could benefit from government on-line assistants who answer questions by electronic mail. These assistants could help the citizen find an agency or another on-line service. In this way, on-line services would be friendly to all citizens, not only those who are already computer literate.

User-friendly interfaces are critical to the success of electronic service delivery. Citizens will compare new ways of delivering government services with current commercial services using state-of-the-art interfaces. Therefore, government electronic services must be user-friendly, up to date, and high in quality to assure success. Active "information filters" will be necessary to help the user manage the massive amounts of information appearing on the Internet and other computer networks.

Agencies should develop directories or participate in governmentwide directories or gateways, such as FedWorld, that facilitate citizen access. An electronic kiosk presentation must anticipate a diverse set of queries and be kept up to date, since the kiosk allows the user to respond only to what is already in the computer. The information on electronic bulletin boards or other on-line services also must be kept current. Even the telephone voice response system, one of the easiest systems to use, can frustrate users if they receive too many recordings, lines are busy, or they are put on "hold."

Another important aspect of the "human factor" is protecting the privacy and security of personal information (see also ch. 7). Unless adequate precautions are taken, citizens could perceive that new electronic services will be used to store data that could later be used to exclude them from medical benefits or jobs. Business transactions, tax refunds, and public assistance benefits are all subject to abuse. On the other hand, the technology—if properly implemented—can provide more privacy protection. Security can actually be improved through the use of technologies such as encryption, passwords, caller identification, and

use of tokens such as smart cards or biometric identifiers. [53]

User Cost and Access

An effective technology strategy should also address the recipient's costs for electronic delivery, which directly affect access. On-line services, facsimile, CD-ROMs and other home services require equipment that many people currently do not have. Telephone-based services typically require touchtone telephones, which some citizens do not have. Many automated telephone response systems have not been upgraded to be TDD-compatible for the hearing- or speech-impaired. A small percentage of citizens—some of the Nation's neediest—still do not have basic telephone service. EDI costs can be a barrier for small businesses. Internet-based services require access to an Internet provider, which may be expensive in some areas. Many costs may be acceptable for businesses, but may deny access for individuals. (Access issues related to the telecommunications infrastructure are discussed in ch. 3; also see chs. 5,6, and 7.)

Provider Cost

Government agencies have implemented many electronic delivery technologies with limited budgets. In many cases, the technologies can save the government money and recover the cost of implementation. Benefits often are difficult to estimate, however, and should be calculated over the life of the program. Service delivery includes intangibles that are hard to quantify. How valuable is a new toll-free service for Americans confined to the home? What is the value of a complicated expert system that improves the quality of information on preventive medicine? Improving the quality of services may also increase demand, thus increasing overall costs. The technology strategy could examine these and related questions from a governmentwide and long-term perspective, rather than from an individual program viewpoint.

53 See U.S. Congress, Office of Technology Assessment, *Privacy Rights in Computerized Medical Information*, forthcoming. See also U.S. Congress, Office of Technology Assessment, *Electronic Record Systems and Individual Privacy*, OTA-CIT-296 (Washington, DC: U.S. Government Printing Office, June 1986), and Defending Secrets, Sharing Data, OTA-CIT-310 (Washington, DC: U.S. Government Printing Office, October 1987).