

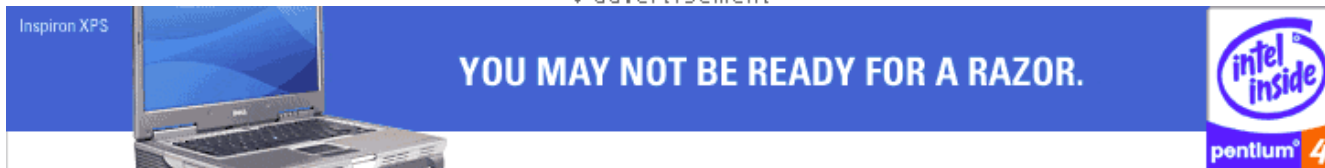


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## A life-saving technology

By [John Borland](#) and [Jim Hu](#)  
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**In a small military hospital in Guam, a cardiac patient lay unconscious as a catheter was slid carefully into the right chamber of his heart.**

The surgery was fairly routine, save for one notable absence: The physician in charge wasn't in the operating room during the procedure. In fact, he wasn't even on the island.

Dr. Benjamin Berg supervised the entire surgery while in front of a computer screen 3,500 miles away at Tripler Army Medical Center in Honolulu. He dictated the procedure to the less-experienced colleague who performed the operation, monitoring every move with a high-resolution video camera while getting instant sensor data from the catheter itself.

[Day 1: A life-saving technology](#)

"The real-time information requires a continuous broadband connection," Berg said. "The delay in the transmission of data about pressure inside the heart would be unacceptable."

[Day 2: Why policies must change](#)

The delicate process illustrates why high-speed Internet access--once considered a luxury--is viewed increasingly as a necessity. Broadband is being used in projects that could revolutionize such critical areas as education, health care and public safety while creating enormous opportunities in business and entertainment.

[Day 3: South Korea leads the way](#)

Realizing that potential, however, has been a perennially elusive goal. To date, Internet development has been marked by extremes: Although the nation has a glut of "backbone" bandwidth that can move data from coast to coast in an instant, these high-speed networks slow to a relative crawl at the infamous juncture known within the industry as "the last mile"--the local connections that link ordinary homes and businesses to the Internet.

[Day 4: Cable, DSL face threats](#)

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The transportation



NexGen City's wireless broadband system was installed in June by the police department in Garland, Texas.  
Source: NexGen City

### Washington, D.C.

"First responder" wireless project has:

- Completion date of late summer 2004.
- Ten transceiver sites to cover entire city.
- Download speeds of at least 1.5mpbs.
- Estimated cost of \$2.7 million for first year.
- Applications such as remote detection of chemical and biological agents, video surveillance, video support for helicopters and bomb squads, doctor support for ambulances.

### Emergency test

Washington, D.C., is testing a new wireless broadband network that would provide mobile high-speed data, video and audio feeds to police, firefighters and emergency crews. The one-year trial project was started with an experimental license from the FCC and with equipment from Motorola and Flarion Technologies.

Public safety officials say this is the future, but they need another big chunk of the airwaves--now destined for auction to the private sector--in order to make this type of system work efficiently. A group made up of local public safety officials is lobbying Congress to make this happen.

### Chipping in funds

In a recent survey, most people said they would pay \$1 in Internet access fees to fund a broadband network for police, fire and emergency crews.



Source: CNET News.com-Harris Interactive poll of U.S. Internet users.

metaphor is apt, as policymakers are recognizing that fast Internet connections are as essential to the future of the economy

now as railroads and highways were in the last two centuries. Those systems transformed the way people lived and worked, irrevocably changing human conceptions of distance, speed and time. Even in its relative infancy, broadband is already having much the same effect.

So important is the technology that it has been elevated to a [national campaign issue](#) this election year. President Bush and Democratic challenger John Kerry have each outlined plans to increase investment in the technology as part of their platform agendas, and policymakers of all stripes cite it as an important driver of future economic growth.

"If the United States is going to maintain its ability to grow its economy, I think the continued proliferation of broadband technologies is key to that solution," Federal Communications Commission Chairman Michael Powell said in a speech in May. "This is the central communication policy objective of the era. It's more than talk now. It is time for action."

Critical uses for broadband technology are multiplying every day in a wide range of fields:

- **Public safety.** Emergency services--including firefighters, police forces and medical crews--see wireless broadband as a vital addition to their tools, and are lobbying Congress to help improve these capabilities. Municipalities from Milpitas, Calif., to Washington, D.C., are experimenting with technologies that can speed emergency response times and help provide environmental data such as hazardous chemical readings.
- **Health care.** "Telemedicine" has long been one of the most promising applications for high-speed networks. Rural and outlying hospitals and clinics rarely have access to the expertise and experience of doctors in urban centers. But diagnoses and consulting can be done with the help of high-quality audio and video and of real-time data connections between central and remote facilities.
- **Education.** Schools at all levels are already using high-speed Internet connections in teaching and research, and many see the networks as ways to help smooth out the radically unequal distribution of resources between different regions and institutions. Colleges provide access to course materials online, via streaming videos of lectures, for instance. High schools use the Internet for research purposes and help students create their own multimedia Web sites.

### A matter of economics

Despite the recognition of broadband as an important issue across the political spectrum, not everyone agrees that it merits federal involvement. Skeptics and fiscal conservatives say the government should not provide funding or tax breaks to develop broadband networks, arguing that such financial incentives are unfair and could disrupt natural competition in the marketplace.

To be sure, much of the push for faster networks comes from high-tech companies that stand to benefit directly from equipment sales.

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These businesses have lobbied heavily and consistently for greater national investment, particularly since venture capital for telecommunications dried up with the dot-com bust.

At the top of the scale are giants like Cisco Systems and Nortel Networks, which provide the routers and other technologies that send data across networks. Smaller companies would also benefit, such as [OneEighty Networks](#), which last month helped create a 100-block-wide public Wi-Fi hot spot in its hometown of Spokane, Wash., or [Tropos Networks](#) of Sunnyvale, Calif., whose equipment helped Garland create a public safety network based on Wi-Fi.

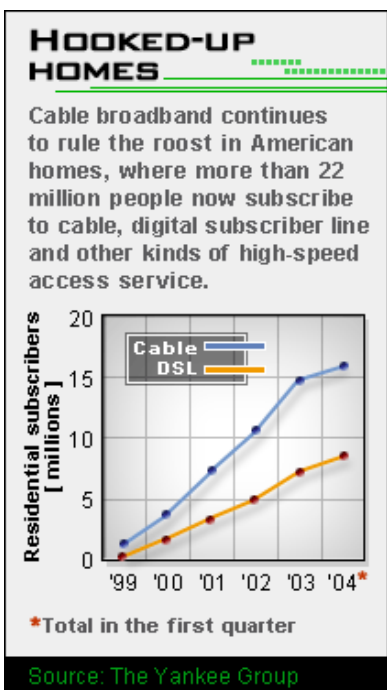
But economists say the positive effects of broadband will be felt far beyond the networking industry and could add between \$300 billion and \$500 billion a year to the U.S. economy. One widely cited study, led by a Brookings Institution researcher, predicts that ubiquitous broadband access could create 1.2 million jobs in the United States.

New employment could come from such companies as [Visicu](#), which provides the equipment that Berg's hospital in Hawaii uses to monitor intensive care unit operations in Guam. Within information technology alone, expanding businesses would range from small companies like Illinois-based [CyberTech Media](#), which digitizes video for presentations inside corporate networks, to industry stalwarts like Intel, which sees broadband wireless components as a new market.



**Cultural change will come from high-resolution applications into the home.**

--Mark Cuban  
former Yahoo executive and chairman of HDNet



Many economists view broadband as a vital part of the next technology wave that they believe will drive growth and improve productivity. Although no one is predicting anything on the scale of the 1990s high-tech gold rush, broadband could make real many theoretical uses of the Internet touted in the early days of its development as a mainstream medium.

Such prospects have prompted rural development agencies into making plaintive calls for broadband investments, to avoid being left out of another digital economic boom.

"We see broadband as a key, key component for economic development in this region," said Marc DeFalco, who heads the telecommunications program for the [Appalachian Regional Commission](#), a 13-state economic development agency. "We look on broadband as a means of opening up rural areas to the same opportunities that people would have in urban areas."

That's already happened for Bobby Tuck, who heads Tuck Mapping Solutions in Big Stone Gap, a small Appalachian town in Virginia's Eastern tip. Tuck, whose company specializes in aerial mapping, used to swap floppy-disk files with his clients when he started his business years ago. But as technology progressed, the files got larger. He soon found himself loading hard disks into his car and driving to clients' offices--sometimes meeting them halfway, if he was lucky.

The files eventually got so big--some reach 150GB--that Tuck was on the verge of relocating, despite having been in the area for 20 years. Then last year, a regional planning commission won funding to bring a fiber connection to the area, and Tuck's business turned around.

With access to a 100-megabit-per-second connection, the company could suddenly download critical data files in two or three minutes, where it had taken 8 hours before. The business is now staying put, and others in the area have found new opportunities.

"What it's done for us is make us a major player in our field," Tuck said. "We could work almost anywhere, once we have access to data. It doesn't make a whole lot of difference where we're located."

**Their trouble with fiber, but difficulties in building networks will mean slow going.**

Fiber-optic broadband makes DSL look as outdated as two cans and string, with its potential to give homes connections as fast as 100mbps or more.

SBC and Verizon have said they're finally beginning to make serious investments in bringing the technology to homes. Verizon said last week it would offer speeds of up to 30mbps, beginning in Keller, Texas. But unless you're moving into a newly built suburban

## From the ER to the ABCs

Broadband's benefits are being felt in countless other fields, especially those that rely on real-time access to detailed and complex information. In some cases, it can deeply affect the way children learn or even mean the difference between life and death.

To emphasize the technology's urgency, proponents cite a broadband project being built on the frontlines of homeland security for firefighters, police officers, ambulance crews and other emergency workers in the U.S. capital. The wireless network will enable doctors in Washington-area hospitals to conduct preliminary examinations of patients in ambulances via live video streams. Police officers engaged in high-speed chases will get real-time footage from helicopters, while bomb squads will be able to inspect dangerous sites remotely.

"These are applications that already exist and could greatly enhance the capability of our first responders," said Robert LeGrande, deputy technology officer for Washington, D.C., who is lobbying Congress to set aside more wireless spectrum for public safety.

The multimillion-dollar system, still under construction, is being held up as the future of public safety by lobbyists seeking funds and more wireless spectrum for similar projects. While that process continues, communities as far-flung as Garland, Texas, and Milpitas, Calif., have already created Wi-Fi broadband services on a smaller scale for their own public safety forces.

Other technology pioneers have long since seen tangible benefits.

Dr. Bruce Dunn of Clement J. Zablocki Veterans Administration hospital in Milwaukee was one of the first doctors in the country to create a "telepathology" practice serving a hospital 200 miles away. Through a broadband connection, his computer receives video images from a remote-controlled microscope in a sister hospital in Iron Mountain, Wisc., which he uses to diagnose cancers and other diseases in tissue samples.

Many more doctors exchange large data files such as X-ray results, which do not require real-time connections but still need high-speed networks. Hospitals have found broadband technologies to be invaluable in non-life-threatening situations as well, saving considerable labor and other resources by using it to handle medical claims, insurance processing and other administrative tasks.



Doctors tap broadband to monitor patients a mile away.

Play video

The idea of health care via broadband has even extended to the home. Federally funded studies have found "dramatic" improvements for patients who could communicate with doctors through frequent videoconferences and other technologies. A Florida project serving [children with diabetes](#) recently found that patients using the videoconferencing system spent about a fifth of the time in hospital as before, saving tens of thousand of dollars.

Just east of Los Angeles, a project at [El Monte Union High School](#) shows benefits of broadband that do not involve emergency services but have had other dramatic effects.

El Monte's administrators recently got a grant from the Beaumont Foundation of America to set up wireless broadband towers on campus, providing Internet access on school grounds. But a related part of the project has secured laptop computers

neighborhood, don't throw away that old cable modem yet.

Here are a few of the sticking points that keep fiber from being an overnight success story.

### Winning rights of way

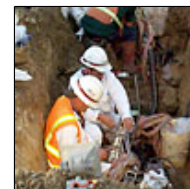
A company first has to figure out the easiest and cheapest place to put fiber networks, often running lines under city streets or through private land in order to connect homes with central switching facilities. In some cases this will involve getting permission or rights of way.



President Bush has created a working group to help companies work with federal agencies to streamline this process when federal land is involved.

### Digging up streets

The biggest problem is getting fiber in the ground. In new neighborhoods, developers can dig trenches and put fiber in before the streets are laid. In urban areas, digging up pavement is difficult and expensive, making fiber to every home an unlikely proposition in the near future.



In some cities, conduits already exist underground. Fiber can be pulled through these tunnels without new trenches having to be dug, as was the case with SBC's Mission Bay development in San Francisco.

### Lighting the fiber

Optical fiber is just expensive strings of glass unless electronics that can send and interpret data are put at each end.



Most fiber-to-the-premises projects use a technology called "passive optical networking," which allows download speeds of 622mbps and uploads of 155 mbps. The technology lets that bandwidth be split, so a single fiber could be shared by several homes, for example.

### Fiber cuts

The bane of fiber networks is the backhoe. Construction projects are notorious for accidentally cutting through fiber-optic cable while digging underground, throwing networks into temporary chaos or total darkness. Telephone companies have considerable experience in fixing these outages quickly, however.



for children living in a nearby trailer park, and the school is now providing them with broadband access to do research and other homework.

"Schools in the low end or in the high end socioeconomically need to look the same," said Nick Salerno, an assistant superintendent with the El Monte Union High School District. "We must provide the same opportunity for everyone."

Many other broadband educational applications are transforming teaching and research. University courses are routinely recorded and put online for students who miss class or for those who cannot afford to attend full time. Boys and Girls Club of America chapters are getting live underwater video feeds from a project exploring shipwrecks on the floor of the Black Sea and the Mediterranean Sea.

### A new world of entertainment

On the campus of the University of Southern California, students and researchers are being exposed to broadband uses of another kind.

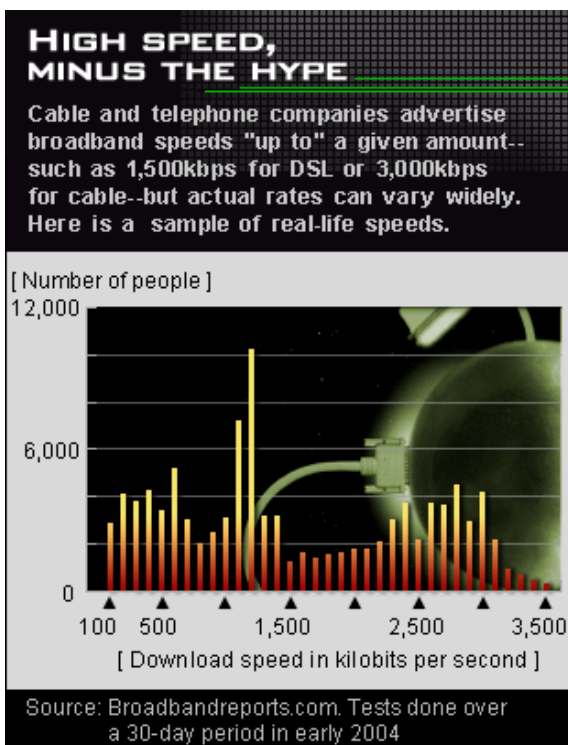
In a darkened lab, a high-definition video of a space shuttle launch fills a viewing screen. Its sounds shake the floor, rumbling from 10 speakers around the room, each with its own audio stream.

This IMAX-like experience shows the potential for broadband networks in ordinary homes--in movies on demand, virtual reality games and even teleconferencing, said Isaac Maya, the director of Industry and Technology Transfer Programs at USC. The shuttle video and all 10 channels of audio--four more than on most DVDs--are streamed in real time from services in Georgia over a superfast Internet2 network.



**Broadband  
proliferation is  
the central  
communication policy  
objective of the era.  
It's more than talk  
now. It is time for  
action.**

--Michael Powell  
chairman, Federal Communications  
Commission



"The vision is immersive presence," Maya said. "How do you get people in separate locations to feel each others' environments? It's not just video, it's not just audio, it's not just the Internet. You have to do them all."

This potential is part of what excites visionaries in entertainment and consumer markets. If high-speed Internet access becomes ubiquitous, entrepreneurs and media experts have said, the experience of home entertainment, sports, games, communication and anything else connected to the Internet will change radically.

"That's a really big economic driver coming down

vice president of the [Internet2](#) project, said. "But it's a chicken-and-egg problem. You've got to get the technology deployed before these applications become reality."

Industry veterans say national broadband access will only lead to major changes in U.S. society if connection speeds get exponentially faster than those typical of cable and DSL today. Otherwise, the most likely result will simply be better use of existing technologies, such as those for e-mail, Web surfing and music downloading.

"We need 100mbps or more to the home before we see an impact," Mark Cuban, the former Yahoo executive who now owns the Dallas Mavericks and who runs high-definition cable channel HDNet, wrote in an e-mail. "The cultural change certainly won't come from HDTV, but it will come from high-resolution applications into the home."

That type of connection looks less like science fiction with each day. At the recent Fast Net Futures industry show in Santa Clara, Calif., a pair of companies called Ikonos and Metalink demonstrated 100mbps downloads over a 1,000-foot telephone wire. Telecommunications carriers, meanwhile, say it has become nearly as cheap to wire a brand-new neighborhood with high-speed fiber optic cables as it is to install slower copper wires for DSL.

Still, that vision remains far from reality in the United States, at least until companies start seeing economic motivation—or consumers start demanding—superfast broadband connections. Just ask the high-tech thinkers inside the adult entertainment industry, who are often the first to see profit potential and to act on any impending technology.

"We haven't put forth any efforts that require money," said Wicked Pictures Director of New Media Anne Petrie. Her company offers products for today's broadband subscribers, but has yet to address next generation services, she said. "At this point, we're basically circling the airport, waiting for the connectivity issues to be resolved." ■

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