Home smart home

Are you ready for a house that talks back?

By Daren Fonda
You live on a pretty street somewhere in America. You're married, with kids, and you work a lot, mainly from your home office. Life is so hectic that you have no time for yourself, and you're looking forward to a getaway in Paris with your spouse. Before you leave, though, you'd like to improve your French and learn more about the culture. Meanwhile, you're thinking more prosaically: What do I make for dinner? You decide to tap into that uncanny reservoir of intelligence, your house.

First, you turn to your kitchen counter - which has a small LCD screen with Internet access - to search the Web for software on France. It quickly suggests a program called "Learning French Culture in the Home." You tell it to pay for the software, and it's instantly downloaded. You smile as the electronic picture frame embedded in your wall glows with images of a lush Bordeaux vineyard.

Then it's time to cook. You ask the house what you can make with the food you've got. "Thinking" that you would like something to match the moment, it suggests five French recipes. There's a fancy chicken dish you've wanted to try, yet you're missing a couple of ingredients. No problem. You instruct the house to buy the items, which are delivered through a shuttling system linked to a grocery distribution hub nearby.

Meantime, your home realizes there's an opportunity for you to learn French. Your kitchen takes on a stronger French ambience: Edith Piaf sings in the background; images of Notre Dame and the Champs Elysees fade in on the video screen. As you cut your vegetables, your home gives you a little French lesson, saying "Vous coupez les legumes" ("You are chopping the vegetables"). You repeat the line, and, as you continue preparing the meal, you learn other phrases.

Sometimes your house amazes you, it's so smart. It knows you're alone in the kitchen, and it notices when your daughter comes in. Earlier, the home had been running a program for her on the science of food, and it's now consulting the Internet for information on the foods you're using for your meal. Since you're cooking with wine, an interactive...
display on grape distillation pops up. The home stops talking to you in French, realizing it's inappropriate with your daughter in the room. A short film on Louis Pasteur starts playing on the wall, enthralling her as she nibbles some carrots. After it's over, she runs out to have a teleconference with her classmates, and you hear her tell them all about pasteurization. Just then, your home gently reminds you - in French and, then, because you didn't respond, in English - that your coq au vin is ready.

Sound outlandish? A bit too much like science fiction? Not to architect Kent Larson. If he has his way, this vision may soon seem more like Ozzie and Harriet than The Jetsons. The scenario is something Larson and his team dreamed up recently to win support for their House of the Future project at MIT. On his drawing board are plans to build three of the world's smartest dwellings: a laboratory house on MIT-owned land in Cambridge, near Central Square; a "transgenerational" home, designed to address the needs of retiring baby boomers, tentatively planned for Hilton Head, South Carolina; and a house showcasing the next generation of energy-saving materials (for which a site has yet to be determined). So far, there are no blueprints for any of these homes; the lab house is the only one scheduled for construction, starting in about a year. Nonetheless, as it gets underway, the $11 million project promises to be one of the more comprehensive attempts at forecasting domestic life a few years from now.

As its chief visionary, Larson is guiding several teams of future-minded folk. Computer scientists are writing software that will enable the laboratory house to learn and adapt to its occupants' routines; engineers are making prototypes of smart appliances and of walls that will "think" for themselves - and for you - as well as assorted other digital gadgetry. Architects, graduate students, and artists are grappling with design issues, conceiving ways for the house to fit its residents' lifestyle as closely as a handmade glove. Larson will ensure that all these experts communicate, devising solutions from a whole-house perspective. Forming a consortium, they will develop their own technology, supplementing it with help from MIT's engineering departments and laboratories.

Outside institutions are getting involved, too. Researchers from the division for aging at Harvard Medical School will work with Larson to create a system for the laboratory house that will function as a virtual doctor; the American Association of Retired Persons is assisting in addressing issues important to senior citizens; and corporate interests are lining up. Eight companies - including Compaq; Procter & Gamble; and Owens Corning, the home-insulation giant - are each paying up to $100,000 annually for intellectual property rights to Larson's research, and more companies will probably sign on.

What's driving Larson's research and much of his thinking about the future is "Moore's law," the so-far accurate prediction - made in 1965 by Intel cofounder Gordon Moore - that computer-chip power would double every 18 months. The law has already put computers on our desks and laptops in our briefcases and is spurring an engineering
revolution in everything from our cars to our credit cards and washing machines. If, as expected, the prediction holds out for a few more years, we will see artificial intelligence embedded in the very structures of our homes, blended into our countertops, cabinets, walls, and floors. When that happens, says Larson, our houses will get very, very smart. Walls will know if they need repairs; windows will shut if they notice it's raining; medicine cabinets will call you if they detect a child trying to open a pill bottle. Our homes will contain a digital infrastructure that will change our relationship with them as radically as electricity once did. They will also be custom-designed to reflect our individual tastes and needs - architecturally unique to each one of us to a degree so far available only to the rich.

This, at least, is what Larson hopes to demonstrate with his project, which he calls "Housen," using the letter in mathematics that signifies an unknown variable, which, in this equation, is the individual. The house of tomorrow, he says, will reflect whatever "n" means to you, the resident of the future. It will be a house that adapts to you, changes with you, does, in effect, whatever you ask.

A few trends seem to be emerging about how we will live in this wired new world: More of us will do more work from home. Bedroom communities will evolve into dual residential and commercial spaces. An endless stream of products will be ordered via the Internet. Information appliances (today's computers) will help us with everything from consulting a doctor from the privacy of our living rooms to "having dinner" with our children away at college, all through giant video screens. As we spend more time in our houses, they will take on new importance. Good design will be critical, as will technologies that are both useful and user-friendly.

To figure it all out and avoid building a latter-day Edsel, Larson is doing field work, studying people's habits in real-life situations. Last year, for instance, he sent a team of investigators to Cadbury Commons, an assisted-living facility in Cambridge, to interview elderly residents about tasks they had had trouble with at home. Many residents complained that simple chores like putting groceries away or reaching cabinets that were too high eventually proved insurmountable, spurring them to leave their homes. "It started us thinking about what these people would find practical," Larson says. "What could we develop, technologically and design-wise, that could keep them living independently? We'll be doing more studies, going into various communities to address different issues before we start designing."

Hearing Larson talk, one might think he's a high-tech kind of guy. Like any good master builder, he has an authoritative presence. At MIT, he dresses sharply, wearing an Armani sport coat and Missoni tie; his bearded face is ruddy, his figure trim. He speaks slowly, with a Midwesterner's steady conversational keel. Yet, for a man so future-minded, he refuses to part with certain ways of the past. He makes his home in Brooklyn, New York, where he shares a 19th-century row house with his wife, Beth, an opera singer, and their 9-year-old daughter, Olivia. The house contains basic electronics - TV, VCR, and
several computers, which Larson uses for work - but it is mainly
gadget-free. The family doesn't even own a microwave oven. Larson
shops for food at the local farmers' market and says that, in an ideal
world, he would live in a farmhouse in the Tuscan countryside. When
he isn't thinking about all things digital, he relaxes by playing jazz
guitar and tending the roses in his garden.

How, then, did Larson, who is 45, get involved in smart-house
forecasting? Since 1981, he has had an architectural practice in New
York, where he and his partner, Peter Gluck, design institutional and
residential spaces. Among their many commissions, they created an
award-winning addition to a Mies van der Rohe house in Weston,
Connecticut, and designed a conference center and business school
addition for Columbia University. But it was Larson's reputation as a
digital artisan that got him noticed at MIT and, eventually, started him
thinking about tomorrow's housing. In 1992, he started an ambitious
project to create 3D computer images of unfinished designs by the
legendary architect Louis Kahn. Time magazine raved about the
project, calling Larson's rendering of a Kahn synagogue "a stunning act
doing digital cyber-architecture." The dean of MIT's architecture school,
William Mitchell, was also impressed, and in 1995 he invited Larson to
join MIT as a research scientist, giving him an opportunity to expand
the project. Eventually, it turned into a book and culminated in an
exhibit at MIT's Compton Gallery, in which spectators could
manipulate views of Kahn's buildings, shifting light and perspective by
moving small models of the structures themselves. It was a complex
system conceived and designed by Larson - a mix of artistry and
technical sophistication. Together with Larson's previous work, the
Kahn project as a whole would so inspire Mitchell that he would decide
to back Larson's vision of building a house of the future.

Larson and Mitchell had, in fact, been interested in similar issues: How
could digital technologies be used in the home? How could computers
be used to design better, cheaper houses? How could architects design
dwellings to reflect social changes spurred by the technology revolution
- changes in life spans, living arrangements, work and play patterns?
Such big questions would have no easy answers, but Mitchell wanted
MIT at the forefront in finding solutions. As Mitchell would write in his
recently published book, E-topia, "architecture is no longer simply the
play of masses in light, it now embraces the play of digital information
in space."

Tomorrow's home, in the view of Mitchell and Larson, will most likely
contain a nervous system - sensors, computer chips, digital circuitry -
embedded in its structure. Shelter will remain its main function, but it
will serve other purposes, too, interacting with occupants, learning and
adapting to their needs. Software for the home's floors, windows, and
walls may well be as crucial as a solid foundation and could be put
together from a kit, from factory-made components. A young couple
would be able to afford a new home custom-designed to their lifestyle,
since technology would bring the architect's skills to the masses. The
home would finally become what the architect Le Corbusier called for
70 years ago: a "machine for living."
Even at the turn of the millennium, we're still far from this ideal. A decade ago, Life magazine predicted that "by 2000, half of all new houses will be substantially computerized." But excluding Microsoft chief Bill Gates's house, with its powerful operating system (which reportedly doesn't work too well), the house-as-machine concept hasn't caught on. For most Americans, a home-automation system is as close as it gets. Such devices coordinate one's lights, security and sprinkler systems, audio-video equipment, and ventilation, making it possible to write scripts for the house: At 8 a.m., the alarm goes off, music starts, lights turn on, and coffee starts percolating, with variations on the theme. Yet, while the technology is expected to improve rapidly, fewer than 1 percent of US homes are fully automated, according to the Dallas-based market researcher Parks Associates.

One reason the systems aren't popular, says Larson, is that they require too much programming, resulting in overautomation rather than flexibility. For all their trouble, the systems' applications are limited, he says, partly because electronics and appliance manufacturers can't agree on a technical standard for their products to "talk" to one another. Until a common protocol emerges, our homes won't even approximate the networked systems Larson foresees.

And yet it's always worthwhile dreaming, and MIT is a worthy place to do it. As the nation's oldest and arguably most technically driven architecture school, it has long had a reputation as a hotbed of experimental house design - responsible for some of the century's most forward-thinking homes. Larson's project will be in good company. During the Depression, MIT-trained architect A. Lawrence Kocher, along with Albert Frey, designed a dwelling "for contemporary life" that they dubbed the Aluminaire House. A demonstration model of the three-story rectangular building was displayed in 1931 at the Allied Arts and Building Products Exhibition in New York City. The architects pioneered the use of light-steel structural metals, thin but effective insulation, and inflatable furniture - along with ultraviolet lighting for indoor tanning. A quarter-century later, an MIT architect named Marvin Goody designed an all-plastic, quad-winged house for Monsanto that went on display at Disneyland in 1957. The idea was to demonstrate "what plastics could do," so nearly everything was made of the synthetic material, from the kitchen counters to the desks, chairs, and folding room dividers. During the 1960s and '70s, the school was at the forefront of developing home-based solar energy, and, now, in the same tradition, it is applying digital technologies to home design.

At a recent MIT workshop for graduate students, Larson showed slides of past houses of the future, partly because he wanted his students to see how the greatest dreamers went wrong. The architect Norman Bel Geddes, Larson pointed out, predicted in 1931 that all roofs would have gardens; windows would be sealed; and mechanical devices, controlled by "photo-electric cells," would open doors, serve meals, and remove dirty dishes and clothes to "appropriate departments of the building." A house of tomorrow from Chicago's 1933 Century of Progress International Exposition featured an airplane hangar, since the architects George and William Keck thought every family would have
its own personal aircraft. (The house did get some gadgetry right: built-in dishwashers, electric garage-door openers, dimmer switches, and central air conditioning.)

Perhaps most intriguing, Larson told his students, was Buckminster Fuller's bold, brilliant failure, the Dymaxion Dwelling Machine, a giant metal pod that Fuller unveiled in 1945. The house seemed to have popped from Aldous Huxley's Brave New World. It looked like a bulbous flying saucer suspended from a central mast and featured bizarre, futuristic devices like rotating shelves. Nonetheless, Larson noted, the Dymaxion boasted engineering and design elements ahead of its time, "attributes we still aspire to." Among them: walls that were supposed to generate their own energy; maintenance-free materials; spaces that could be reconfigured according to occupants' activities. New industrial techniques were supposed to make its components cheap to manufacture. And it was designed as a kit, to be erected on-site, just weeks after ordering.

Fuller's big mistake, though, was that he was too ideologically driven - a pitfall Larson says he will avoid: "Fuller made no attempt to respond to the core values of society. In fact, he disdained these values and wanted to change people through design, a notion which was naive and unworkable. He imposed an alien way of life on people, and they didn't want to live in this environment."

What kind of house do people want? Lately, there's been no shortage of speculation. Consider, on the radical side, a computer design for something called The Digital House, invented by New York architects Hariri & Hariri and featured at a recent exhibit at the Museum of Modern Art. The home is organized around what the architects call a "digital spine." Surrounding the spine is a glass enclosure made of flat-panel liquid-crystal displays, the "building blocks of the future." Like Fuller's Dymaxion, the house would be built from prefabricated modular panels. The panels would plug into the steel structure like an industrial shelving unit, allowing the house to be reconfigured at will. The walls would function as giant porous media screens, capable of broadcasting internally or externally. (A homeowner could use the house like a giant interactive billboard, generating income by advertising products to the world outside.) All bedrooms would come equipped with a "dream recording device," so one could "review one's dreams on the liquid wall of the room at any time." A virtual chef would help prepare meals in the kitchen. The architecture, say the designers, would allow the family members "to interact virtually but live together actually, addressing the paradoxical American desire for a solitary existence and family interaction at the same time."

It's doubtful we will see many "digital houses," as Hariri & Hariri conceive them, if only because the design is light-years ahead of what Americans say they want in a house. Popular tastes tend to be more conservative, as shown by some other futuristic homes sponsored by builders and magazines. A house of tomorrow designed by the Santa Barbara architect Barry Berkus and constructed by the giant homebuilder Centex Homes outside of Dallas looks a bit like a medieval

fortress, with twin towers, a synthetic-stone veneer, and heavy brick styling. It features stuff anyone can have now: photovoltaic shingles, a geothermal electricity system, high-speed Internet access in every room, movable walls. A home sponsored by Better Homes and Gardens magazine, designed in part from responses to a readers poll, was similarly traditional. Readers said they hoped for a classic facade with lots of time-saving technology and security gadgetry inside. The magazine is sponsoring the construction of this house in North Carolina. Like the Centex home, it will feature movable walls, plus a central vacuuming system, remote-activated keyless locks, and "fiber cement siding" that won't need retouching as often as wood. A networking system will provide Internet access from anywhere in the home, and the house will include PC-based video phones. All in all, more convenience, lower maintenance, and better Web service in a home that looks more like yesterday than tomorrow.

What Larson is after is something different: a complete rethinking of the home-buying process and a new model for how we interact with our residences.

Start with the design. The current model of the suburban home should be obsolete, he says. Today, he points out, there are three kinds of houses in America: traditional, older homes that evolve through renovation; houses designed by architects for wealthy, adventurous clients - a tiny fraction of the housing market; and developer-built houses that make up the bulk of new-home construction, about 1.7 million units annually. When most Americans buy a new house, this is what they get: some variation of a suburban "spec," crafted according to the builder's marketing research. But while such homes may be among the most affordable, they rarely exhibit fine architecture, says Larson. "Housing is usually a family's most expensive investment," he says. "But most people can't afford an architect and live in spaces poorly tailored to their needs."

The aesthete and designer in him doesn't like what he sees. "These houses superficially graft historical elements onto otherwise conventional and banal forms," Larson complains. "Almost any historical detail, hackneyed or not, looks better to people compared to the bad examples of modernist architecture they see next to it." The middle-class American should be able to do better, says Larson, and he thinks a process called "mass customization" - something that has already revolutionized the computer industry - could help. The idea is to give people the digital tools to design and perfect their own house, which they could order over the Internet as they would a computer. Say you fancy a 2,500-square-foot home, designed with an alcove office space, three bedrooms, a playroom, a solarium, and a built-in gym. You visit a builder's Web site and key in your preferences (or tell the computer through voice-recognition software). The program offers several plans; you manipulate walls, ceiling heights, any architectural detail through a graphical interface. The computer recalculates the design based on a set of "accepted architectural principles" (an admittedly vague concept, says Larson, that would have enormous impact on how well the house worked). You then send your plan to a
real-life architect for fine-tuning; the builder gets a digital blueprint and coordinates construction of your house, using many modular, prefabricated parts to keep costs down.

No doubt this system would initially be costlier than current mass housing models. And choice would be limited by time, money, and the sophistication of the computer program that calibrates your design. But "smart developers," Larson says, "would price a base model competitively. Most people would pay a premium to have a house tailored to their needs, that could adapt over time, that was higher quality than the alternative. We plan to develop economic models to show how to do it."

So let us fantasize further. Much of the house would be ordered pre-made from the factory. Walls would snap together on-site, already outfitted with a complex array of circuitry and sensors, forming a digital infrastructure. The exterior might be made of a "skin," almost reptilian in its ability to adapt to the environment. Brick and mortar and aluminum siding would yield to smart fabrics: carbon fiber, high-tech glass, light-but-durable metals. They would be designed to insulate or cool, adapting to changing seasons or to environments with extreme heat or cold. The home would continually run diagnostic tests on itself, identifying structural stresses, detecting internal moisture buildup. The longer you lived there, the more it would learn your habits. It might remind you, for instance, that you have a tendency to leave an upstairs window open in winter, contributing to higher heating bills. The roof might generate electricity through photovoltaic shingles. A few years from now, when electric companies are expected to offer variable rates - charging less for off-peak use - your house might save you money by ordering the washing machine to start up when prices are lowest. Electricity could be drawn from the grid during off-peak hours and stored in fuel cells for later use.

Interiors would also be custom-digitized. "Some people will want to interact with the technology all the time," says Larson. "Others, baby boomers like me, will want it so far in the background they never notice it." Every room would have Internet access through different display technologies: projection units, PDAs (personal digital assistants, like a Palm Pilot), LCD touch-screens discreetly embedded in walls. Electronic media would converge through these portals: They would be conduits for everything Web-based, including music and video on demand, plus personal teleconferencing. If you were away on a business trip, you could still help your daughter with her homework, face-to-face. Your home office might include a wall-size screen so you could visually interact with co-workers on demand.

The kitchen would be the hub of vast changes. Already in the works is a microwave that would "know" how to cook a frozen meal without any manual instructions. More revolutionary is Larson's plan to embed microchips and sensors into the kitchen's countertops, pantries, and cupboards and network them with smart appliances. With "digital tags" on food packages, the entire kitchen could then monitor and inventory what objects are brought in and out. Larson is developing home
applications for the technology in a joint collaboration with the Auto-ID Center at MIT's department of mechanical engineering. Researchers there say it will only be a few years before microchips costing only pennies will start replacing the bar codes on packaged goods, allowing the objects to communicate their vital statistics to sensors and computers anywhere. (The consumer-goods giant Procter & Gamble, one of Larson's sponsors, is heavily involved in developing the technology and hopes to implement it as soon as possible.) A package of noodles, for example, could identify itself to your pantry, "telling" it, in effect, that it is a package of noodles, what it costs, where it was bought, and when it entered the cabinet's domain. The refrigerator would know if you had run out of milk. The cupboards could tell you if you're low on paper towels or canned soup. Those same noodles would be networked with every other commodity in your kitchen, and all of it would funnel through to the Internet. Which is where Larson's virtual chef steps in. Like the one in his scenario, it could suggest recipes for dinner based on what you've got on hand. Before your next shopping trip, the whole kitchen could inventory what you're out of and give you a list of things it knows you like. It might shop for the best deal on the Internet, alerting you to sales. Or it could order the supplies for you, so you never run out.

Ultimately, Larson says, we might never physically shop for goods like toothpaste again. The home might come equipped with an automated shuttling system that could distribute such items to their appropriate cupboards anywhere in the house. Supplies would be delivered through hatches or tunnels from a neighborhood distribution hub nearby; or smart, electric vehicles would drop the goods off through chutes in the ground. No more delivery vans. Less pollution. A world in which you never again have to roam the supermarket thinking about detergents and fabric softeners.

As Larson sees it, the point of developing much of this technology is to make daily chores more manageable for aging baby boomers - a population bubble for whom the ultrasmart house may be more necessity than luxury. The thinking is that once the boomers start to retire, they won't want to live in nursing homes or assisted-living facilities, nor will many be able to afford them. Medical technology will enable scores of boomers to lead healthier, longer lives. They will want to remain autonomous as long as possible, something that the smart house could make practical. It could keep track of bills and expenses. Things like an object-shuttling system or super-smart kitchen could go a long way toward keeping people independent, Larson says.

The possibilities for home health care are perhaps most key. The idea is to create a digital link between the house and the resident, so that it can monitor the occupant's health, serving as a kind of home-care aide. An elderly person might wear a biometric sensor, for example, a tiny computer implanted in his or her shoes, clothing, or jewelry that could monitor vital signs and communicate information through the home. A ring could monitor heart rate and blood pressure and, if it detects a problem, could alert the house, which would call a doctor. The devices might make it easier for physicians to make house calls through the
Internet, since the doctor could access real-time data about the patient's health. The system would serve as a first line of defense in case of an emergency, though it would need to be smart enough to differentiate between normal excitement and a crisis - a major technical challenge.

Larson won't say when, and to what degree, we might see these changes. But there's good reason to be skeptical. It may be a decade or more before the technology advances to the point where Larson's ideas are practical. Much of the technology doesn't yet exist. And the economic incentives for companies to mass-produce it are far from clear. Even more elusive is how much of this technology people will actually want. The thought of maddeningly efficient computers virtually taking over the home scares many people. What happens when the electricity goes out or the house-computer crashes? The lament is already familiar: Everything from the air conditioner to the stereo requires a specialized repairman. What if, to fix a leaky faucet, you have to call not only the plumber but the software engineer as well? Imagine walls that talk back and a refrigerator that decides to cancel your bacon order because it thinks your arteries are getting clogged. It's easy to poke fun at the all-computerized home and say, "Who needs it?"

"You could write a very long book about the future as it didn't happen," notes Robert A.M. Stern, dean of the Yale School of Architecture.

To all of this, Larson says there could be simple solutions. "Computers now run emissions tests on cars from a remote location," he says. "Why couldn't they do something similar with your home? Say your dishwasher software malfunctions. If it's linked to the Internet, it might be able to be fixed from the company's Web site. If it's a mechanical problem, the Web site could call the repairman directly."

Still, technology has a tendency to outpace our readiness to accept it. And gadgetry for the home, where many of us seek shelter from a fast, wired world, might be among the hardest to win broad approval. "Automation scares a lot of people, including me," says Stern. "I think all this equipment is fine. But it's equipment. Architecture is not equipment. There's always a dichotomy between the poetic and the pragmatic. Everyone has a poetic aspiration, something that speaks to you, your needs. We don't want to live in houses that don't allow us to enjoy a mood."

True, Larson says, "but it will always be a matter of personal choice how much technology people will want in their homes. We just want to show what the house will be capable of." Moreover, the issue isn't so much one of technological overload but of design - how to simplify the electronics, improve the interface and discover the killer application: the thing like a VCR that people feel they can't live without. "Cell phones were hard to use at first," says Larson. "Now they're simple. They're extraordinarily complex pieces of machinery, benefiting from good design. That's what we envision for the home."

Nonetheless, some architects are skeptical of a computer, no matter how powerful, replacing the architect's eye. "A machine has never been
invented that can create beauty," notes the legendary designer Philip Johnson. "[Good] architecture doesn't have to have anything to do with technology. Let the house talk back to you. That doesn't change whether it's beautiful or not. The important thing is what the inhabitant says when he comes home at night. Does he say, `My God, what a beautiful place to be?'"

Larson says he's not proposing that machines replace human designers; and the concept of beauty from a machine, he concedes, might always remain fantasy. But the idea of an Internet-based virtual architect, which makes digital designs on command, is just a few steps ahead of where we are today. Already, computational power reserved for multimillion-dollar industrial projects is getting cheap enough for the mass housing market. "The technology is giving us the tools to create geometrically complex structures in a cost-effective way," says MIT's Mitchell. "Calculating complicated designs - like Frank Gehry's Guggenheim Museum in Bilboa - will soon be possible at relatively low cost."

Still, Larson is cautious about overhyping his project. He admits there are issues beyond his scope, like privacy. If the home knows so much about you - what you make for dinner, what kinds of razor blades you use - then safeguarding that information will be critical. "I don't want advertising on the wall as I'm opening a box of Cheerios," he says. "The possibilities for abuse by insurance companies, marketers, the government - just about anyone with an interest in the information - are enormous."

Of a few things, though, he is certain. The technology will not be a panacea. People unhappy in their low-tech abodes will probably remain just as unhappy in their high-tech castles. No home will solve every problem, and no design concept will fit every taste. For these reasons, Larson won't predict what our houses will look like - whether they will have massive front porches or be made from a new plastic that looks and feels like hardwood. There are too many variables down this path, too many "n's" to even hazard a guess. But if our houses make our lives easier, perform rote chores, connect us better to the outside world - all without forcing us to wade through instruction manuals or memorize silly commands, Larson would be pleased. The aesthetics of the home, he says, will always be a matter of individual taste, no matter what the computer brings.