

Implementing Future Technology into the Building Environment

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At the onset of any building project, — whether the construction of a new facility or an existing structure is about to undergo a renovation, — property owners, architects, contractors, interior designers and tenants are faced with the daunting task of installing or upgrading building technologies. Confronted with a myriad of confusing choices in technology equipment, the design challenge begins to escalate, and is quickly compounded by the velocity at which communications technologies are developed with new capabilities that must be implemented. The design team must then integrate the technology in such a way that it can

be “unbolted” easily from the building when the time comes to upgrade or replace existing

technologies with newer ones. The tighter the integration, or the more entwined a technology is to the structure that houses it, the more difficult it is to upgrade and thus the less valuable the building ultimately becomes.

Technologies are one of the most complex and expensive components of any building project, with incredibly long lead times. For this reason, it is imperative that you plan early, and plan well, for the technologies that are going to integrate with your infrastructure.

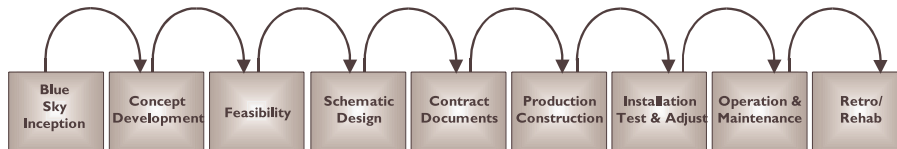
Where to Begin

So how does a property owner select the right building/communications technologies from the plethora of choices available? What emerging technologies will likely have a significant impact on your business and your



customers? What changes will high-speed connections and new wireless technology mean for you? When will video conferencing become more accessible? How will instant messaging work in your office? Your answers will require some strategic planning now so that you're not caught off guard.

At the beginning of any new construction



Typical Project Life Cycle Stages

or renovation project, it is crucial to assemble a team of key decision-makers. Your team could consist of the owner, subcontractors, tenants/employees, architects and construction managers—anyone who is impacted in some way by your choice of technology should be included. Members of your team will bring their expertise to the table, and together, will research the options, design through problems, and come up with viable, informed solutions.

Once your team has made a decision, you will notice the level of stress rise dramatically among those who will use the new technology usually employees or tenants. Unless the technology is transitioned thoughtfully, those who

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Winter 2001



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will interact with it will not understand it. Plan for the transition during the design and construction process; don't wait until after the technology has been installed. You may want to consider creating a training center outside the scope of the project so that those who will use the new technology will be ready to implement it when the building is ready to be occupied.

What Experience Has Taught Us

Companies that facilitate advanced integration of new technologies into their building infrastructures will experience a change in their operational procedures, their user attitudes, and in their products and services. That's because new technology always impacts processes and products to some varying degree. For a successful implementation, and to minimize disruptions and errors, you must manage and plan for the new technology in the design stage.

New technology can and usually will annihilate existing standards. It can increase or decrease a building's cost per square foot. It can change the number of square feet per employee, especially if it mandates an increase or reduction in staff. Finally, it can shift the number of employees per dollar of earned income.

Equally concerning can be the decision making process itself. A time line problem can evolve as companies realize that the implementation of new technology will alter the way they work, which changes their requirements, thus in turn generating a circular decision making process that seems to have no beginning or end.

For these reasons, building owners must consider several issues prior to selecting and installing any new technology. A typical building project traditionally starts with well defined design criteria, these may include:

- The number of employees or tenants you have now.
- The anticipated growth rate over time.

- The ratio of open-plan workstations versus private offices.
- The amenity and service areas required (including file areas, storage space, coffee room, mail and copy centers, and conference rooms).
- The circulation and efficiency of space.



Project Life Cycle Evolution

The overriding concern is how to accommodate the functional aspects and characteristics of a building to the space and technical requirements of the proposed technology.

Technology Rich or Dependent Projects

Today's buildings incorporate a variety of technology-rich and dependent projects. In addition to the familiar LAN (Local Area Network) and WAN (Wide Area Network) systems, there are new connectivity issues to consider, including file, communication, web, and database servers. Where will they be located and how can you protect them? Desktop video and teleconferencing systems are becoming more sophisticated, with equally demanding requirements. The choice of cabling becomes equally significant, depending on whether you use traditional twisted pair (if so, what category for what current or future protocols) or fiber optic cabling. Finally, there

are connectivity transmitters that may need to be accommodated, including TI, DSL, Wireless, Microwave, and Satellite devices.

The Bottom Line: Smart Informed Planning

No business remains untouched by technology. The preponderance of computerized and wireless systems and gizmos in every facet of society is evidence of that. The key to success is developing a plan that seamlessly integrates any new technology into your existing infrastructure, while ensuring compatibility with existing or future technologies that may be added later.

All of these technologies, and many that were not mentioned, place additional demands on your building schedule, space and utility requirements, as well as the systems and technologies that run your facilities. The goal is to achieve a holistic design solution that keeps business running smoothly and employees operating efficiently.

Integration Checklist

Here are some guidelines to help you achieve technological synergy across any enterprise.

✓ *Plan Well and Plan Ahead*

Identify the technology issues you face and determine solutions. The better you plan for new technology, the easier it will be to detach it from the building's infrastructure and upgrade it with a newer technology in the future. The alternative is to try and retrofit technology into a building after it is completed—a slow and expensive process. Create detailed manuals that clearly illustrate the new technology for owners and tenants.

✓ *Begin Early*

As with many building components, lead times for custom software and equipment can be painstakingly long. If you need to integrate the

new technology with other systems, determine how that will be accomplished. Also be aware that the new technology will alter the way tenants and employees work and will change their requirements. For example, many tasks that were previously performed manually may now be automated. How will that change an employee's need for workspace and or location?

✓ *Assemble a Knowledgeable Project Team*

Gather together key specialists to execute the planning stage, including, but not limited to, experienced designers, technical consultants, construction experts (both managing and contracting) and your facilities personnel. Your team should know where to go for answers and be adept at problem solving. They will become invaluable not only to the owner(s) of the building, but to the employees/tenants/customers in making timely, coordinated, and fundamentally cost saving decisions.

✓ *Simplicity eases Integration*

Leading edge (or "bleeding edge") technology will increase the cost of a project. If the technology is technically unproven and has not yet been embraced by mainstream society, it has a shorter life span (remember beta?). To reduce the cost associated with replacing or installing technology, make sure that it can be separated from the building without creating problems in other areas. The tighter the integration, the sooner your capital investment becomes an albatross.

✓ *Always have a Contingency Plan*

Delivery and installation is just the tip of the iceberg. Set-up, testing, and troubleshooting of integrated systems can add months to the delivery of fully functioning systems. Make sure to include dual systems, or mirror sites in your plan. This will help ensure that you have something in place that can take over if your technology fails.

Conclusion

As designers providing a service we must ask ourselves: How can we best serve our client? What are the options? How do we select the right ones? What steps can we take to enhance the client's productivity in order to ensure that a new facility is responsive to their future needs as well as protect their capital investment?

Award winning architecture and interior design, state-of-the-art technology and fully leased buildings are among the results of a thoughtful project process. Designers and all of the project team members are charged with providing clients an efficient environment that supports and enhances their business mission. This should always be the goal.

Harnessing the Innovation of Future Technology

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Do you think technology is advancing at a rapid pace today? If so, then you'll need to brace yourself for what's just around the corner. Expect the volume of emerging technology coming to market to skyrocket in the next 10 to 20 years. And with the surge of innovation, expect your customers and employees to demand ever-increasing levels of service and communications from your company.

The automobile used to be called the "horseless carriage." When silent movies added sound, people called them "talkies." Soon, the term "cellular phone" will be outdated as well. Instead, your former cell phone will contain so many applications, and be capable of accessing so many different devices, it will need a new name. Perhaps you'll call it an information management device or, more simply, a hand-held device.



The explosion in wireless technology will do more than change our vocabulary—it will likely have a significant impact on our daily personal and professional lives. If you want to remain competitive in the business world, you'll be using a variety of multipurpose wireless devices, not only to communicate with other people, but also to communicate and interact with your environment as well. Total connectivity and network awareness (both private and public) will be commonplace, with manufacturers delivering intelligent devices in tiny packages that will connect virtually anything to the Internet, including building controls,

sensors, industrial measurement devices, and medical equipment. Consider a “smart” medicine cabinet that always knows what’s in it, or perhaps computer technology embedded in our clothing. How about getting a complete physical via a biosensor in your filling every time you brush your teeth?

Generally, people misunderstand the shifts in technology. Society tends to think of things in the future doing what the current generation does, but in a new format. Instead, consider changing your notion of buildings by imagining the services future devices will provide. Then, the most important thing to consider will not be what technology does, but how the technology influences your life and the life of your business. Lives will be irrevocably changed when machines become “smart;” when they can be taught, or rather programmed with information that helps recognize and predict behavior. Thus, architecture and building design will turn from static places to interactive environments that facilitate new, more efficient ways to work and live.

When it comes to new construction or renovation, how does an owner account for future technologies in the building planning and implementation phases? Moreover, what are some of the technologies of the future that owners should be considering today? How can owners and designers utilize the communication protocols on which the Internet rests as a fabric to knit technology devices, building systems and business plans into an intelligent network?

Bluetooth Technology

By now, nearly every technologist has heard of *Bluetooth*, a wireless technology that connects different devices using radio signals. However, the vast majority of mainstream society wonders if it is a new dental procedure! If nothing else, it promises to make the cables and wires that connect PCs, printers, PDAs (Personal Digital Assistant), and fax machines obsolete.

More intriguing is the possibility that Bluetooth will allow devices to communicate with each other, allowing easier collaboration between mobile computing devices and the creation of what enthusiasts call “personal-area networks.” But before Bluetooth ends up on your desk, its creators have to address several roadblocks. There is the possibility that Bluetooth signals could interfere with certain local area networks (LAN). There are also concerns about having such devices—and their radio signals—aboard aircraft, due to their potential interference with cellular communications on the ground.

How it Works

Bluetooth uses microchips outfitted with a tiny radio transceiver to communicate with devices within 10 meters of each other. The Bluetooth technology makes all connections instantaneously and without an inch of cable. Operating on a frequency of 2.4 GHz, Bluetooth uses spread-spectrum technology and can transfer both voice and data at a speed of 721 Kbps to 1 Mbps. It facilitates fast and secure transmissions of both voice and data, even when devices are not in line-of-sight. The radio operates in a globally available frequency band, ensuring compatibility worldwide and up to eight different devices can communicate at one time using Bluetooth.

The New Business Scenario

Besides the obvious benefit of being able to use computers, PDAs, and other devices without having to fumble with cables, Bluetooth’s greatest advantage is the ability it gives people to communicate with devices like printers, whiteboards, and fax machines—as well as with each other. During a meeting, for example, participants using Bluetooth-enabled laptops could be posting comments to a plasma whiteboard. At the same time, information put on the whiteboard would appear on their computers.

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I mostly see this technology as an enabler for collaboration. I leave a meeting, and the last thing I usually hear is 'I'll type up the notes and e-mail them to you,' as opposed to 'I just sent them all to you.' Or your handheld device that you carry with you already has a complete copy of notes, graphs and drawings as you exit the building.

Imagine shopping at a local department store on a Sunday. As you pass by a poster, the featured photograph instantly transforms from a young woman wearing Levi's jeans into a pro athlete wearing a football jersey. The electronic ink (e Ink) built into the poster has accessed a dynamic database of information from the smart chip in your cell phone or PDA to ascertain that you are a die-hard fan of the Minnesota Vikings. Suddenly, the poster speaks to you via text. It says, 'Hello, John. The Vikings are up by seven at the half. We're having a sale on big-screen TVs in our electronics department. Why don't you go check it out?' You respond, 'No thank you. I need to by some blue jeans.' Continuing the conversation, the wallpaper or series of posters offers you a discount on jeans since you are a preferred customer. Now, at this point, it would be intriguing to bargain with the interactive wall for a better discount, but you get the idea.

Working virtually anywhere

Each of us has been through the office shuffle. It's not just about moving desks and credenzas. The real problems are the wiring issues. With people moving around, companies growing and adding space, and companies looking at "*hoteling*" instead of assigning full-time offices, the challenges of cost-effectively wiring offices continue to grow. But new wireless standards are changing the way we look at connecting offices.

Lucent Technologies, Cisco Systems, and others have released wireless LAN technology using the 802.11b 11-megabit wireless standard at distances of about 100 meters. Using this

technology, you can allow workers within a building to move around freely while avoiding the high cost of wiring offices with Category 5 wiring.

In fact, by combining wireless LAN technology and wireless phones you can allow your workers to go anywhere in your building (and sometimes outside) and still be able to work. This same technology is also being deployed outside the building in commercial and residential areas to provide wide area networks (WAN).

In fact, the Lucent solution will allow you to use the same radio cards (with different access points and antennas) to build both a local and wide area network. This is rapidly becoming the preferred way to connect campuses, both college and company.

If it all sounds farfetched, think again. Smart appliances are shipping now from mainstream manufacturers like G.E., Honeywell, Intel and Motorola. Massachusetts Institute of Technology (M.I.T.) has created e-Ink for industrial and commercial use, in addition to a PDA-like device that is integrated into a pair of glasses. The inside of the lens becomes the display screen by interacting with your eye movements.

Additionally, there are several building projects currently under construction that are being built from the ground up solely dependent upon new technologies. Take for example a new 4 billion-dollar theme park being developed in Kansas. All of the rides and attractions have been designed utilizing the latest 3D design software that Hollywood uses to generate their movies. The digital representations are tied to the actual rides so they are displayed in motion over the Internet. The twist comes with participants via the Internet being able to control the rides and the outcomes. They control the duration that people can participate, how many times they perform certain sequences in the rides, etc. Visitors to the park are given their own handheld device



(if they don't have one) so they can participate and interact with their environment as well. I think Walt Disney would have loved this idea. So how can you possibly plan technology like this into a facility you are building now? You have to look at what's on the technological horizon to understand how near-term technologies can impact your building and your business. Many technical innovations are currently being developed and tested. Some of these will fail to be adopted by mainstream society, but many will be. In conjunction with your architectural design team, you can work to accommodate them into your plan.

Let's look at some of the trends and predictions about our technological future.

Future Trends and Predictions

- Wireless will be one of the hottest technologies in the designs of buildings and their systems over the next 10 years, and not just as it applies to cell phones. Unfortunately, wireless systems currently have some drawbacks. Most are painfully slow, with data moved at about 1Mbps to 2Mbps, and some networks running on a tortoise-like 14.4kbps. There is also a frustrating lack of coverage in key areas with a lack of standard protocols. Finally, wireless systems may require large expenditures of time and money, as well as specialized expertise, to incorporate them into a company's IT infrastructure.
- New technologies will create intelligent buildings by integrating all of the systems we rely on into a dynamically interactive

environment. Moreover, technologies currently under development are being designed in such a way to free the infrastructure so people can concentrate on tasks instead of dedicating their time to the systems that support their daily functions.

- The day is coming soon when we won't be tied to a desk or workstation. Any supervisor or manager will be able to access data from any portal interface in the building. The facility manager will be able to walk through a structure and get readings on the health of the building. Taking that a step further, soon you will be able to walk into a room and take a quick inventory of the data residing there. A table, a chair, and even a wastebasket will be able to talk to or negotiate with some other device (yours or an inanimate object) and transfer information. Additionally, car manufacturers may wind up giving away their products when the automobile evolves into its own information portal or web browser. Businesses will pay the automobile industry for their clients/employees to use so they can access their company networks, their global positioning systems or maybe just their banking and investing systems. Just look at the Time-Warner AOL merger: Is it that unrealistic to imagine the new mega-company buying the troubled Daimler-Chrysler and using their automobiles as their new media? GM already has OnStar, let's just take it a step further.
- Wearable electronics are in the process of being developed. With this technology, wires are run through machine-washable clothing, enabling your shirt, jeans or socks—even your underwear—to become your laptop, PDA, or cell phone. The very clothes you wear will be interacting with your environment—including the building environment. Soon we will be able to approach our work associates, with technology integrated into

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our clothing or person, and exchange data without saying a word. Your smart chip will be interacting exclusively with another person's (or a building's) smart chip.

- Finally, it will be possible in the very near future to implant a cell phone or PDA under your skin, no batteries required. The natural electrical forces of your body will power the device. This technology, though impressive, may be bordering on the invasive.

What This Means to Owners, Managers, and Builders

The possibilities for our technological future are endless. The real issue is practicality. What technologies will be deemed acceptable by society? How much data do we want or need? What about the privacy issue? Instead of wiring the infrastructure, *empower the person*. Whereas current *wired* technology is fraught with privacy issues, expensive to install, and therefore unavailable to many, wireless technology can already nearly duplicate the functionality of hard-wired systems. You can put the technology in somebody's clothes so it's with them all the time. And if it's on them, they own the bits, not some third party vendor. It is a concept that could work in tandem with smart spaces, all designed to enhance quality of life.

All of the new technologies in progress have one thing in common: they are easy to

unbolt, or separate, from their carrier. This makes them easy to upgrade or replace, without incurring unnecessary expense. It is this ability to de-integrate from the infrastructure that will drive the trends of the 21st Century.

The task for owners, managers, and builders will be learning to manage new and mainstream technology in the building environment. We will be forced to rethink the ways in which “*social*” technologies are brought into the work place—and determine whether or not they belong there.

Brick and mortar no longer envelope and restrict the new workplace. If a person has a cell phone and a laptop, they have all the elements they need to do business. Business owners along with architects (and the rest of the project team) will need to be planning and designing for the workplace of the mind. The emerging e-Business practices we see being experimented with today are rapidly becoming entrenched and commonplace, and we can all look forward to the fact that they will take on new forms that we can hardly imagine today. The key to success in facing the challenge of this transition lies in understanding the underlying dynamics of work and design processes. Businesses must have the agility to adjust expectations and practices as those processes reconfigure themselves in the new environment.

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