The design implications of technology

By Jerry Laiserin, FAIA

The pervasive use of networked computers and multimedia equipment in the work environment adds a new element of complexity to the architect's job. While designers typically possess a working familiarity with building services and physical infrastructure, few have comparable mastery over the requirements of information services and technology infrastructure. But understanding the space-planning requirements and design implications of computer communications and multimedia environments is rapidly becoming an essential part of everyone's practice.

Getting Informed

It's difficult to get practical information about emerging technologies. New subjects, not yet included in the registration exam, may not be offered at architecture schools. So some architects turn to their peers for practical information. The Computer Applications Committee of the AIA/New York Chapter, for example, which previously focused on CAD and other tools, has broadened its focus to include information technology systems and changed its name to the Information Technology Committee (ITC).

John Howell, AIA, chairman of the ITC and a technologist at financial services giant J.P. Morgan, says architects must “learn to get comfortable designing for technology, not just with technology.” To further that objective for the ITC's hundreds of participating architects, Howell organizes committee seminars on subjects like virtual private networks, riser management, and structured cabling. The ITC arranges “backstage tours” of communications-intensive facilities like Four Times Square (March, page 91) in New York City. Consistent with his duties at J.P. Morgan, Howell is certified as a network equipment specialist by the Building Information Consulting Services International, an industry standards group. He believes, however, that “most architects won't need to become network equipment specialists themselves, but will need to know who the experts are and how to work with them.”

Electronic Systems Associates (ESA) is one of a new breed of consulting firms that is helping architects integrate computers and media into buildings. The company has 10 offices around the country, located with those of its corporate parent, engineering firm Sysoxa & Hennessy. ESA president Stephen Fredette, who has prior experience as a systems integrator, says architects must be aware of planning issues to accommodate wiring in new or renovated spaces. Just providing adequate room, appropriately located, for network communications equipment is significant, he says.

For example, when designing rooms to house servers there must be enough space in front of and behind the equipment racks to allow access for maintenance. High-speed network equipment requires ample, round-the-clock ventilation and cooling. All digital electronics depend on clean electrical power and an uninterruptible back-up supply. The location and path of power wiring in walls, above ceilings, or under floors should be separated
Distribution closets, which house hubs and patch panels for LANs, should be spaced in a pattern on each floor that minimizes extreme differences in the length of cable runs, and they should also be vertically aligned from floor to floor to minimize signal-degrading kinks and offsets in risers.

Eric Rochelson, ESA’s director of audiovisual systems, points out other considerations for media-intensive spaces, such as boardrooms, videoconference centers, and training facilities. Rochelson highlights issues such as clearances required for near-screen video projection equipment (6 to 10 feet behind the screen); the need to conceal in-room, half-height equipment racks within custom millwork enclosures; and the requirement for network and power connections to be directly integrated into conference tables and desktops.

Display systems and network equipment typically are linked to the building’s HVAC and security-control systems. Security for boardrooms, where confidential matters are discussed and transmitted electronically, demands space-consuming countermeasures against espionage—installing layers of electromagnetic shielding in the walls to prevent digital eavesdropping, for example. Another strategy is to introduce masking noise in the room’s enclosure and ductwork to deter acoustical eavesdropping.

The router’s connected to the backbone

Even with the help of consultants, architects still must take responsibility for their own work. And a consultant may not always be available for critical planning meetings.

James Greenwell, AIA, of Greenwell Goetz Architects in Washington, D.C., often works with technology infrastructure consultants but says that his firm’s guiding objective is to ensure that the architectural solution is driven by the client’s workflow, not by the flow of electrons from building backbone to workstation. Ideally, the design process should be client-centric and not technology-centric.

“We first ask clients, ‘How do you get your work done?’ and ‘What kinds of spaces do you need to support that?’” Greenwell says. “Then we ask, ‘How do you use technology in the work product?’”

As clients move to a more flexible mix of private versus community workspaces with fewer floor-to-ceiling partitions and fewer systems furniture “cubes,” getting LAN cabling from the desktop to the server is an issue. Raised floors (or depressed slabs) and poke-through access systems, in which power and communications connections emerge from under floor decking, address this need, but add yet another dimension to the impact of technology on space planning.

To be sure that project architects can knowledgeable and simultaneously address aesthetic, functional, and technological issues with clients, Greenwell Goetz encourages professional development within their firm. “All other factors being equal, the company’s hiring policies favor applicants with technological expertise,” Greenwell says. The firm invites technology consultants and engineers to conduct formal staff-training sessions on new and emerging infrastructure issues. Less formal lunchtime seminars are held at the firm to share “lessons learned” and “best practices” from the firm’s many projects for high-tech, communications, and financial clients.

Finally, Greenwell Goetz has two full-time information technology staffers who are required to stay current with developing technology and are available as in-house consultants for project teams. Ultimately, in Greenwell’s view, every architect in his 60-person firm should know at least as much about routers, hubs, and cable risers as they know about stacks, vents, and plumbing risers.

WWW For a list of infrastructure technology product and service vendors, go to Digital Architect at: www.architecturalrecord.com

Technology terminology

**Backbone**: This is the major artery of networked systems. Smaller networks may be attached. Some companies and owners prefer multiple backbone connections to foster competition and to create redundancy in the event of failure.

**Conditioned Power**: Electrical service that is protected from line noise, voltage surges and spikes, brownouts, and blackouts.

**Distribution Closet**: A room containing equipment racks filled with hubs and patch panels for arranging LAN connections.

**Hub**: A passive device for splitting LAN signals and distributing them among multiple computers, servers, and other network-attached devices.

**LAN**: A Local Area Network, or collection of interconnected computers, servers, and hubs within a company. Multiple LANs linked together form a WAN, or Wide Area Network.

**Premises Wiring**: The communications cabling within a building or individual tenant space, usually provided as part of tenant fitout, not as part of the base building.

**Riser (Management)**: Connections from the building backbone to separate tenancies or multiple buildings, typically in multistory buildings. Leading vendors include Allied Riser, Intellispace, and OnSite Access.

**Router**: A special-purpose, active switching device that links a LAN to a backbone or links multiple LANs to a WAN. Vendors include Cisco, Nortel, and 3Com.

**Server**: A computer designated as a shared resource on a LAN.

Leading vendors include IBM, Compaq, Dell, and Hewlett-Packard.

**Structured Cabling**: A complete system of wiring, connecting devices, and installation standards certified to deliver a specified data-transmission speed over a LAN.

**Systems Integrator (SI)**: Like a general contractor for computer systems, an SI procures and installs all the structured cabling, servers, computers, and software for a LAN.

**Virtual Private Network (VPN)**: A private network built within a public network.

**WAN**: Multiple LANs linked together by physical or virtual connections.

**Wire Management**: A system of raceways, cable trays, and/or ducts to consolidate and organize cables within and between equipment racks or office furniture.
Digital Architect

Making project collaborations effective

By Jerry Laiserin, FAIA

Now that most architects rely on computer and communication technologies to perform office functions and project work, these systems are influencing how architecture firms work together. The connectivity afforded by digital tools makes possible new levels of coordination and management control in single-project associations, more formal joint ventures, and permanent partnerships created by mergers or acquisitions.

Expertise by associations

An "association" involves two or more firms providing architectural services for—and sharing the credit and fees from—a single project. For example, national or international firms with expertise in particular building types, such as convention centers, museums, and performing arts spaces, associate with local or regional firms knowledgeable in local codes, contractors, and approval processes. Often, the firm providing construction documents or construction-administration services will be named "architect of record." Some firms associate for the purpose of seeking a project, while others hook up after one firm already has been awarded a principal role in the work.

Differences in the roles of the participating firms affect the technological side of the collaboration, according to Tim Rice, AIA, information systems manager at LMN Architects in Seattle. This 130-person practice frequently shares project responsibilities with other firms. LMN has served as the design or building-type consultant to other firms, as the prime architect with local associates in distant cities, and as the Seattle architect of record for out-of-state practitioners.

In particular, Rice distinguishes between projects with a distinct hand-off from one firm to another at the end of some designated phase and projects with continuous collaboration across multiple phases. For those with a distinct hand-off, explains Rice, it is critical that the "hander" monitor the "hander's" progress, starting from all drawings setup, so there are no unforeseen problems when the drawings are exchanged.

The best technique to avoid such surprises, says architect Elizabeth Skowronek, the associate in charge of technology at 90-person Gwathmey Siegel & Associates in New York, "is for knowledgeable parties on both sides to see down at the early stages and work through all the issues, like setting which office standards will apply to the project documents." Skowronek finds that the variety of CAD systems is rarely an issue as long as both firms agree on the basic choices of drawing conventions, layer/level naming, and so on.

Collaborations across multiple project phases pose greater technological complexities, more file translations, and additional coordination issues. LMN has participated in many such continuous collaborations and, according to Rice, derives many design and practice advantages. But these collaborations may also create inefficiencies.

"The whole point of CAD features like reference files is the efficiency of drawing things only once and then referencing them in other drawings. If one firm works on base floor plans while another firm handles details, however, that dynamic link

When collaborating firms use different CAD programs, such as Autodesk's AutoCAD (bottom) and Bentley's Microstation (inset), special care must be taken with file conversions.
of reference-file information is broken," Rice says. He also finds that the alternate method, known as "round tripping," in which each of the collaborating firms takes turns successively editing the same file, can cause data degradation on every translation. The best course, Rice says, is to decide which firm will own which drawings during which phases. This means that each firm will spend some additional time and money redrawing in its own files those changes made by the other firm.

**Joint ventures**

The Jerde Partnership International in Venice, Calif., specializes in themed environments, like the Mall of America in Bloomington, Minn., or CityWalk at Universal Studios in Los Angeles. According to architect Thomas Jaggers, Jerde's vice president and chief technology officer, many of the 125-person firm's projects are so large that they need to form joint ventures with other architects to execute construction drawings. While there is no clear dividing line, joint ventures typically entail closer collaboration over a longer term than do associations, which are looser and more ad hoc. Consistent with this closer collaboration, Jerde emphasizes a fully integrated technology process for joint ventures that includes the choice of tools, the level of standards, and an insistence on high-speed communication capability.

Jerde has developed a process of two-way workflow that Jaggers calls Construction Document Administration. Says Jaggers, "This is based on all participants matching our tools: Microsoft Office, AutoCAD, 3D Studio, Internet-compatible E-mail, and file transfer protocol (FTP). The entire team needs to have comprehensive, universal standards that are flexible enough for all team members to participate." Because CAD layers play such a crucial role in such standards, Jerde developed its own layering system. Jaggers finds the AIA's CAD Layer Guidelines too inflexible to accommodate the multiple engineering disciplines, landscape architects, environmental graphics designers, and others involved in large international projects.

Another significant coordination issue for joint ventures is keeping the team's software in synch throughout a multiyear project development cycle. "We may start a project today with AutoCAD 2000 as our software standard," observes Jaggers, "but by closeout in 2005, most of the team will have upgraded two or three times and some members may no longer be on the same version." This problem is equally true for scheduling or word-processing tools. While not imposed as a contractual obligation by Jerde on its joint venturers, the firm issues a project book of standards with the expectation of conformity throughout.

A high-speed connection to the Internet has now become part of that "expectation of conformity." An ISDN link at 128 kilobits/second (128k) is the minimum acceptable, in Jaggers' opinion, and is widely available in the Pacific Rim countries where the firm works extensively. Jerde prefers its joint-venturers to have a fractional T-1 connection at 384k or faster, wherever it is available, especially as the firm expands its electronic workflow to include not just CAD files but also scanned images, 3-D models, and digital project photos. Jerde recently installed an in-house video-conferencing system. Even renting the video connection with the joint-venturers at $600 per hour saves substantially on travel time and expense for distant project locations, like Hong Kong.

**Mergers and acquisitions**

When two firms permanently combine resources, the resulting transaction may be characterized for legal and accounting purposes as a merger or an acquisition, but the effect on the combined practice is identical. In either case, many of the same technological concerns of an association or joint venture apply. The permanence of the relationship, however, demands a deeper sense of commitment by the new partners.

Architects sharing work need to establish strict procedures that define which firm is responsible for which files.

"People need to go in assuming there will be compromise on both sides, and they should expect to make a significant investment in getting all the technology up to the same high level," states Carl Roehling, FAA, president of the Midwest group of regional offices within SmithGroup Inc. in Detroit. Within the past few years, this 1,000-person multidisciplinary firm has increased the number of its offices by more than 50 percent through mergers and acquisitions of firms in Manila, San Francisco, Michigan, and Washington, D.C.

SmithGroup was bigger and had more resources than the firms it absorbed and "therefore brought a higher level of infrastructure," according to Roehling. Merging CAD software, e-mail systems, and local area networks was generally easy because the compatibility and conversion issues associated with these mainstream tools are well known. Merging some applications proved problematic, however, when the staff members of a merger partner expressed preferences for tools that did not match the firm standard.

For example, when some merged employees had to switch word-processing applications, the firm had to provide document-conversion templates and additional training to smooth the transition. In other instances, change in procedure, not software, was the issue. Some project managers in merged offices preferred the immediacy of keeping their own job-costing spreadsheets over having to wait for centralized accounting reports to be disseminated from SmithGroup's Detroit headquarters. This reluctance was overcome by making the reports, generated in the CFMS/Advantage accounting system from the Harper and Shuman division of Deltek Systems, immediately accessible via SmithGroup's wide area network (WAN).

The firm's WAN also supports an Intranet, or Web browser interface to internal files [March 1999, page 39], that enables everyone in the far-flung practice to share the same view of the same information at the same time. This technology makes mergers more effective because communications and connectivity knit the organization into a cohesive whole. Roehling concludes that "earlier waves of mergers among distant partners did not work as well from a management perspective, but now communication substitutes for transportation, making a large firm much easier to run."

**WWW** For more information on project collaboration tools go to Digital Architect at:

www.architecturalrecord.com
Database management systems for architects

Digital Architect

By Jerry Laiserin, AIA

Even before computers came along, architectural practice revolved around information management. Throughout their history, from codes and costs to soil borings and schedules, architects have had to marshal all the possibly relevant data and then sort, filter, and massage it into useful project information. In the past, this was accomplished with laborious notes, books, Rolodexes, and perhaps stacks of index cards. Today, many design firms rely on specialized computer software called database management systems (DBMSs) to make this culling and winnowing process as efficient and productive as possible.

Few architects ever interact directly with a DBMS because users are insulated by application programs—layers of forms, queries, and reports specifically designed to shield them from the complexity of data manipulation. While detailed knowledge of DBMS software is unnecessary, it's worthwhile to understand key terms and concepts. With such a background, architects can make better decisions when buying software that depends on database management. And they can be more effective when coordinating and centralizing a firm's business and design information.

What's in a database?
Informally, any computer-based collection of data constitutes a database. Rows of information in a database table are called records. Each record, like each listing in a telephone directory, contains one or more fields of information, such as last name, first name, street address, and so on.

Once data is collected and formatted into records, the information can be shuffled and analyzed in many ways. In a telephone directory, for example, database records are sorted by alphabetizing the last-name field. In an architectural practice, a marketing coordinator might organize a database of projects by geographic area; project managers might sort the same database by number of staff hours remaining in the budgeted fee for active projects; and principals might sort projects by their profitability.

DBMSs ARE SOFTWARE TOOLS THAT STORE, COLLECT, AND FORMAT INFORMATION.

Management systems
DBMSs are the software tools that collect, format, store, and retrieve the desired bits of information. Most DBMSs include a system that generates the forms and reports for entering and retrieving data; a programming language to define the possible operations on that data; and an engine that processes the data according to these defined operations.

There are several types of DBMSs. At one end of the spectrum are flat-file systems, such as Filemaker Pro. These are the easiest to program because they operate on only one level of data at a time. At the other end are relational databases (RDBMS), such as Oracle (from the company of the same name) and Microsoft's SQL Server. These are powerful DBMSs, capable of operating on multiple tables simultaneously and manipulating relationships among the tables. In between these two extremes are systems such as Approach by IBM/Lotus and Access by Microsoft. These are easy to program but less powerful than RDBMSs.

Incompatible data
Commercial software developers rely on DBMSs (typically RDBMSs), in conjunction with other programming tools, when building application products such as financial management programs or specification packages. The actual software purchased by the customer, however, typically contains only the database engine and a set of predefined forms and reports. Thus, a commercially produced marketing program may include forms for making appointments, reminders, and notes about phone calls, and be

Arch Administrator's menu allows access to client and billing information.

Contributing editor Jerry Laiserin, AIA, consults, writes, and lectures about the impact of information technology on the practice of architecture.
be coded as "client_name" for use in title blocks on drawings in a CAD program, as "client" for use on timesheets and invoices by an accounting program, and as "last_name," "fname," and "recipient" for communications via the firm's word-processing, E-mail, and fax software, respectively.

Because of inconsistencies among programs, the staff members end up inputting the same information over and over—a time-consuming and error-prone practice, especially considering that a fully computerized firm uses a dozen or more different applications, from electronic timesheets to digital image libraries, each with its own database.

Coordinating databases
It's logical to assume that the path to eliminating this redundancy is to select one DBMS as a standard and then buy or build only applications that use that system as the data engine. In fact, some software is sold in multiple DBMS versions, though these may not be commercially available for every application. Moreover, it rarely makes economic sense to custom-develop software when a commercial alternative is available, even if that alternative does not use the firm's preferred DBMS engine. Thus, most firms are faced with coordinating data derived from different DBMSs.

Most current DBMSs comply with a standard called open database connectivity (ODBC)—a set of rules that enables one database to connect with another. Most commercial software is built on these ODBC-compliant database engines; in theory, therefore, one could centralize databases by linking these data engines according to the ODBC rules. In reality, this approach is rarely chosen because the link has to be updated every time any of the programs are upgraded.

Designer databases
As a result of these limitations, many large, multi-disciplinary A/E practices with sufficient in-house programming staffs, select a powerful RDBMS as their standard and then buy, modify, or develop a fully coordinated suite of applications. Firms that can't afford this kind of investment deploy architecture-specific application packages developed (often in Filemaker Pro) for smaller firms by fellow architects-turned-software-entrepreneurs.

One such package, by Nina Kim McKenzie, AIA, from Oakland, is Arch-Street Portfolio. A series of software modules or components crafted in Filemaker Pro, Portfolio provides a form or report for almost every imaginable nondrawing function in a design firm. Finith Jernigan, AIA, principal of five-person Design Atlantic in Baltimore, finds Portfolio's selection of forms and reports—from proposals and budgets to field reports and invoices—comprehensive enough that he seldom uses other software, such as Microsoft Word or Excel.

Other examples of these software packages created by fellow architects are Arch Administrator by Paul Smailowicz, AIA, of Bloomfield, N.J., and ArchitectData by Dennis Hughes, AIA, of Tampa. Not only are these packages more attuned to the needs of architects in specific, but AECSoftware, a data-management program well-suited to making and storing ad hoc lists—things like submittal logs and punchlists.

Web-based databases
The technology of the World Wide Web may bring a happy ending to the tangled epic of design-firm DBMSs and their complications. Firm-wide intranets—portals for selecting and viewing in-house data through Web browsers [March 1999, pages 39-40]—create a universal front end for firm data, regardless of its residing place or its original DBMS format. Middleware, the Web software that enables browser front-ends to connect to disparate DBMS back-ends, is much easier to program than most individual DBMSs.

While databases and the applications developed with them remain an unavoidable part of a computerized practice, Web middleware makes it easy to extract and combine data from more than one database in a single on-screen browser view. With the additional potential to link data inside and outside the firm with a single mouse-click, Web technology may soon fulfill the dream of "information at your fingertips."
As computer software develops, its ability to support the way architects work and think constantly improves. While early CAD systems simply drew a line between two numerically defined points, the latest versions work with objects that embody specific architectural information. The term object, in this context, actually comes from computer-science jargon.

In an object-based system, a wall, for example, is more than two parallel lines on the computer screen. Instead, the graphic correlates with a database of characteristics, such as height, thickness, materials, finish, sound-transmission class, and fire rating.

Autodesk's new Architectural Desktop Release 2 incorporates within the software the long-awaited Industry Foundation Classes (IFCs), standardized computer definitions of objects and their behaviors. IFCs were developed by the International Alliance for Interoperability (IAI), an organization dedicated to developing software standards to facilitate compatibility between programs.

James J. Balding, AIA, and Larry Rocha, ASSOC. AIA, the chief information officer of the Newport Beach, Calif., office of Wimberly Allison Tong & Goo (WAT&G), are experimenting with Architectural Desktop to determine whether to use the program throughout the firm. WAT&G specializes in hotels, resorts, and theme parks and has been innovative in adopting information technologies. The firm has long-standing relationships with, and an investment in Autodesk products, training, and customization. Here's what the architects have found:

**The wonders of objects**

"The first breakthrough you have when working with object-oriented software," Balding says, "is when you suddenly realize that you're no longer just drafting but building a model. This is exciting: a revolutionary mindset."

Rocha adds: "While there is a lot of focus on the 3-D graphical representation of objects, the biggest advantage of objects is in the non-graphic data that is attached to them."

Rocha is referring to the architect's ability, with Architectural Desktop, to input and modify an object's attributes with specialized on-screen dialogue boxes. A door, for example, is characterized by its material makeup and its association with a wall. If the architect places the door in the middle of a room, the program automatically snaps it to the nearest wall. If the wall is moved or deleted, the door will move or disappear with it. If the door's specifications placed six inches from a corner, it retains that offset even if the adjoining wall is moved.

"Eventually manufacturers will provide objects with complete specifications, including costs, attached to them," Rocha says. "We'll be able to extract this information with a simple search." He believes this development will not only automate material takeoffs and door and window schedules, but also will ensure their consistency because they come from the same database as the drawings.

Intelligent objects are wonderful in theory, but they can also be difficult to create because of their complex behavior. "A wall is not really a single object but a system of objects," Rocha says. "At WAT&G, we're studying the idea that there may be several levels of intelligent entities. These include basic components such as screws or nails; objects that are combinations of components, such as a knob or a hinge; assemblies that are collections of objects that exhibit complex behaviors and attributes, such as a wall or roof; and building systems, such as a structural or mechanical system." Viewed from this perspective, the complexity of defining objects and their behaviors is even more apparent.

**New on the menu**

In addition to the normal AutoCAD pull-down menus, Architectural Desktop has three new menus: Concept, Design, and Documentation, which contain tools for each phase of design. For example, the Concept menu lists functions that support the creation of massing models. By saving different massing combinations, the designer can compare and contrast a variety of schemes. "We find ourselves using this to communicate ideas to each other and to clients and consultants," says Balding. "These models clarify the three-dimensional space, proportions, design intent, and project scope."

WAT&G architects have been particularly impressed with the conceptual space-planning tools, also on the Concept menu.
designer can develop preliminary schemes conforming to specific area requirements without interrupting the design process to recalculate areas. With the digital equivalent of bubble diagram manipulation, the architect can specify a space's floor area with one plan dimension; the computer will calculate the other dimension and provide a rectangle of the proper size, which can be moved in relation to other area rectangles.

The Design menu's customized objects provide the tools for producing and placing in the model walls, doors, windows, roofs, stairs, and other design elements. This menu is expected to be the most exercise at WAT&G.

The Documentation menu helps the architect annotate 2-D representations of the model. Some of the symbols are more intelligent than their AutoCAD equivalents. For example, each floor tag is associated with a particular door, so when the door height changes, the tag updates automatically without manual editing. This feature not only speeds Customizing objects does not require special programming, but simple editing of values in the associated dialogue boxes. In the process of specifying a wall object, for instance, the thickness of each layer of material within the wall is defined in terms of its distance from a baseline, such as the face of a stud.

Typically, a firm would establish a set of styles to correspond to the wall types likely for a given project. This painstaking process should be conducted by an experienced architect familiar with the firm's construction standards. After the various styles are established, however, it will be far easier for the rest of the staff to apply the styles without worrying about technical details. An object from the menu will automatically contain the necessary data. This will not guarantee error-free design, however, because it's always possible that an inexperienced designer will pick an inappropriate wall type.

Productivity suffers when CAD forces designers to become too specific about materials too early in the design process. "To resolve this, all walls are initially specified as five, six, or eight inches thick," Balding says. "Then, when all the walls have been laid out to an acceptable level, the designer can go back and assign them a more specifically defined style, such as a six-inch stud with two layers of gypsum board on each side. The wall in the underlying database is then appropriately updated. The change is instantaneously reflected in each displayed view. The same can be done for doors, windows, and most other objects." Later, when dimensions are applied, they refer to the revised configuration.

Using the Design menu, architects can also project elevations, sections, and perspectives. These alternate views do not contain the level of detail normally associated with design development and construction drawings but can serve as templates on which to add more detail. For example, a wall in a section might initially show only a few vertical lines representing the stud and layers of gypsum board, but symbols for headers and insulation would have to be added with conventional computer-aided-drafting techniques. Although these 2-D additions are not part of the intelligent 3-D model, they remain visible in the section drawing. An anchor to move such graphic elements with the associated model components when there are design modifications would be an improvement.

In the distant future, every detail of a building will be modeled as an intelligent object. Until then, design and production drawings will necessarily be hybrids of projections from the model with ordinary drafted elements. This means that automated material takeoffs will operate only on the true objects, and architects will need to manually change the drafted elements when the associated objects are moved or modified.

Tapping the knowledge base
DesignCenter, the centralized symbol repository in AutoCAD 2000, is structured as a nested hierarchy of folders. This folder structure is an index to firm-specific object libraries. By opening these folders in Architectural Desktop, designers find thumbnail, wire-frame versions of 3-D objects. These miniatures can be rotated in real time and dragged into the working model. Eventually, DesignCenter will provide the means for architects to archive object-based product information transmitted via the Internet.

Manipulating forms and objects within Architectural Desktop is intuitive and easy to learn for those used to AutoCAD; the interfaces for both are similar, Balding says. Familiar point-and-click and drag-and-drop techniques enable designers to do graphic editing. Nongraphic editing requires selecting data windows from a menu and typing in appropriate data fields.

Both Balding and Rocha look forward to the day when a single model embodies all of the information, graphic and nongraphic, about a building. The promise of the IVI has been that such a model would become a receptacle for design input from all disciplines, throughout every phase of a building's life cycle.

There are still major hurdles to overcome before this becomes a reality, however. According to Balding, architects need greater computing speed and power, reliable operating systems, better Internet-based file management, and more of the building defined in terms of IFs. Architectural Desktop Release 2, he says, is a step in the right direction. ■

WWW Go to www.archrecord.com and click News/Features/Dialogue for more information on technology for architects.
Building a Technology Staff

Firms must develop multilevel strategies to foster an appropriate range of computer skills among design, technical, and administrative staff.

by Jerry Laiserin, AIA

To realize an effective return on their investments in computer and communication technologies, architects must master an ever larger body of new, rapidly changing, and often arcane knowledge about the workings of these systems. From the smallest proprietorship to the largest megafirm, every design practice needs a variety of skills, representing many levels of expertise, that address all aspects of computer technology, including multiple software, hardware, and networking systems. To establish such an inventory of skills, a firm must first decide which skills are appropriate to the regular staff, which should be reserved for designated technology staffers, and which should be handed off to outside consultants. Next, the firm must develop a plan for hiring, training, and supporting—in the right proportions—the personnel who use the technology.

A recent survey of several hundred North American businesses by management consultants PriceWaterhouseCoopers found that difficulties faced in hiring, training, and providing support accounted for nearly three-quarters of all reported problems in planning or using computer information systems. Fortunately, since these three activities are interrelated, resolving problems in one area helps eliminate those in another.

For example, hiring better prepared workers reduces the need for training and support, while an intensive hand-holding style of support minimizes the demand for well-skilled hires or time-consuming training. Striking a balance is an increasingly important pursuit, as personnel-related costs of computer technology now outweigh the direct costs of hardware and software.

Computers are still recent enough additions to most architecture firms that few senior principals have hands-on experience with them. Unfortunately, this lack of understanding at the top makes it more difficult to integrate an appropriate level of technological awareness into the hiring and professional development practices of an office. Paradoxically, one of the oldest, continuously operating firms in the United States, 130-year-old Shepley Bulfinch Richardson & Abbott (SBRA) of Boston, also is one of the most successful in managing and staffing for the latest technologies. SBRA’s experience, as well as that of other firms mentioned below, provides valuable insights into hiring, training, and providing support for design technology.

Whom to hire

According to SBRA’s information technology (IT) manager Brad Horst, AIA, the first rule of technology staffing is distinguishing IT, which deals with applications, from information systems and services (IS). The former includes the software, procedures, and standards for accomplishing practice-specific tasks, like computer-aided design (CAD) or desktop publishing (DTP). Systems and services (the latter) includes computing infrastructure, like hardware and networks, common to any computerized business. Strictly speaking, in-house systems, like local area networks (LANs), are distinct from services such as external Internet connections, but most design firms lump them together under IS.

While everyone in a design firm needs to work with applications, only a few need to become experts. Most architecture firms, including SBRA, promote such experts from within. IS, with responsibilities that relate more to computers than to architecture, can be staffed by nonarchitects or, as virtually the rule with smaller firms, outsourced entirely. Often, the same companies that sold and installed the systems to the architects act as consultants.

At SBRA, all hiring other than for IT or IS positions is still based primarily on architectural talent. But consideration of computer skills ranks a close second.

These are top priorities, echoes Susan Appel, director of recruiting at Gensler, the world’s largest architecture practice with a staff of 1,500 worldwide. “These days, many talented people also have some computer skills, but some of the ‘real 3-D kids’ actually are a little scary. We

Jerry Laiserin, AIA, consults, lectures, and writes about the impact of information technology on the practice of architecture.
worry that they’ll be bored working on 2-D drawings, because not every project justifies the cost of 3-D," she says. "We also have to be sure that we have more experienced designers available to supervise and mentor individuals whose computer skills exceed their architectural knowledge."

With regard to IT staff, both Gensler and SBRA try to hire applications specialists from their own ranks. Before filling an open position, Appel first verifies whether the job requires "someone who is an architect, an applications expert, or a combination of both." When screening candidates, she tries to gauge their "interest and passion to be a computer maven plus the ability to work with design staff." Often the trickiest part of promoting IT staff from within is reassuring candidates that they are not abandoning architecture by shifting from design to technology.

Rus Davary is IS manager for SBRA, which has a staff of 200. Horst and Davary, one an IT manager and the other an IS manager, serve as equals, heading up SBRA's 10-person technology group. This group reports to the firm's information council, one of several such councils through which the firm is managed. Horst stresses the importance of hiring "people who can learn quickly, because the technology is constantly changing."

When hiring IS staff from the outside, Horst avoids search firms that specialize in IS recruitment. Architecture firms "can't compete with the higher salaries paid by high-tech businesses," he says.

Appel at Gensler also finds it increasingly difficult to recruit people. "It takes longer than it once did to fill tech positions, and the salary demands have steadily increased," she says. "Want ads in traditional print media may not be as effective as online services like monster.com." Diligent networking among friends and colleagues is also useful, but Appel worries it can degenerate into "a game of musical chairs, where firms raid each other's IT/IS departments and drive up salaries without expanding the pool of technical talent."

Both SBRA and Gensler have learned that the most attractive lures for new IT/IS hires include offering candidates the opportunity to work with the best technical tools, a clear path for career advancement, and professional development through access to outside technical training. The same incentives that work for hiring are crucial to retaining staff. While SBRA and Gensler point with pride to low turnover rates among their respective IT/IS staffs, other prominent architects have suffered major setbacks when a key applications staffer, like a CAD manager, jumped to a more lucrative position with a software developer—in some instances, with the very outfit that sold the architects their software.

Deciding how big an IT/IS staff to hire, relative to overall firm size, is a quandary. A comparison of the number of full-time equivalent computer-technology staff positions to total staff over the past two decades shows a steady trend toward maintaining larger technology staffs. Not surprisingly, it also indicates a growing performance gap between firms with a strong commitment to IT/IS versus those with less commitment. Firms that do understand the issues and hire accordingly appear to perform better than the technology laggards. A recent study by Zweig White & Associates points to a correlation between increased spending on technology staff and overall firm growth.

At one extreme, there are firms trying to get by with staffing levels that their competitors outgrew early in the 1980s. "Part of the problem is the principals over 40 who grew up in a culture without IT and, therefore, don't understand the nature of many jobs and positions they're hiring for," says Marjeanne Pearson, an Oakland, California-based design management consultant specializing in talent identification and recruitment.

How to Train

Hiring the right mix of people is only a first step. To keep computer users afloat in the continuous flood of software upgrades and conversions, every design firm needs to treat training as a kind of technology lifetime. Given the highly specialized skills required in either area, IT and IS staff must go outside the firm for training—most often to the software vendors who provide the upgrades and conversions.

For example, half the members of SBRA's technology group are studying for the Solaris administrator's exam to master the Solaris operating system used on Sun Microsystems servers and workstations. Similar programs are available for users of Novell and Microsoft operating systems, as is administrator or manager training for word-processing, project management, or CAD applications.

Few if any architectural practices can sustain or justify full-time trainers in house, so they rely on their in-house IT group or resort to outside training courses to provide end-user applications training to the rest of the staff. Outside trainers are especially helpful for smaller firms with overstretched IT staff. While generic training in entry-level skills can be obtained through such local community colleges or vocational schools, or even through self-study, most design firms need training programs tailored to the specific ways in which they use software to help make architecture.

Emmanuel Garcia, a Los Angeles-based CAD consultant and
trainer specializing in 3-D modeling for architecture, notes that "training should be customized, it should be hands-on, and it should provide immediate feedback." Garcia aims to "teach what people need to get their job done."

At SBR&A, newly hired architects get four days of in-house training on Bentley Systems' MicrostationSE CAD software, SBR&A's firmwide standard. The technology group also offers training in a range of other software, from Netscape's Navigator Web browser to the Filemaker Pro database. Each member of the technology group takes a turn teaching end-user classes in a dedicated training room with eight workstations. In addition, some of SBR&A's training in Microsoft Office applications, like the Excel spreadsheet or Microsoft Word, is delivered by expert users of those tools from among the firm's administrative ranks.

Gensler integrates the training process into the overall culture of the firm. "This firm is a learning organization, in which professional development is part of everyone's job." The scope of the subject matter goes far beyond technology, but the end-user resources available include formal seminars, coaches, and brown-bag lunches at which computer users share tips and tricks. Every new employee fills out a questionnaire to identify their level of knowledge about a slew of applications, from Adobe Photoshop image-editing tools to Form*Z 3-D modeling software. Gensler's human resources department tracks these skills and encourages everyone in the firm to upgrade them constantly.

Getting support

"Support" is one of the most poorly defined terms in the world of computer technology. Perhaps this explains why so few architecture firms, even some that excel in hiring and training, do a really good job in this area. Generically, support refers to any on-the-spot, problem-specific advice to solve or work around difficulties with computer software, hardware, networks, or procedures. A major component of overall computer support comes under the heading of systems and services and focuses on hardware and network issues. Because these are computer problems not architecture problems, architects usually get this kind of support from outside vendors or from IS staff, depending on firm size.

Applications support is also necessary. This type of support is a highly personalized form of just-in-time training. An end user experiencing difficulty plotting a CAD file, formatting a Word document, or attaching an image file to an E-mail wants only that one task-specific bit of information that was either never learned or just forgotten.

From the perspective of the applications staffers in IT who are expected to provide answers, the trickiest part often is figuring out whether the question concerns a defect in the user's software or a deficiency in the user's knowledge. In corporate America, entire departments, known as help desks, are dedicated to addressing these questions. Such digital concierges are a luxury few architects can afford. The result, even in very large firms, is a multilayered system of self-help.

"Up to three or four years ago we had a designated CAD person on each project," recalls SBR&A's Horst. "Now we try to build knowledge into the whole team." Gensler formalizes the self-help process with a buddy system that pairs more experienced users with novices.

Such diffusion of knowledge throughout a firm often is embodied in the "go-to guy." This person is any expert user whom other employees treat as a resource—whether or not he or she is formally part of the IT staff. Many firms have begun to codify some of this informal expertise and publish it, along with their in-house CAD standards, in a browser-accessible intranet (see RECORD, March 1999, page 39). The goal, according to Appel, is "to make sure everybody knows where to look and whom to ask for any help they need."

While software vendors offer some support, it is most useful to IT/IS staff, who have the technical skills to decipher the vendor's jargon-laden replies. For many software applications, user groups supplement vendor support. Although some user groups, like AUGI for AutoCAD, or the Microstation Community, hold face-to-face meetings, much of the mutual support takes place in online forums. Evans H. Shu, AIA, of Shu Associates in Melrose, Massachusetts, pioneered this movement as a cofounder in 1987 of DBUG, the DataCAD Boston Users Group. "In larger firms the tech people are removed from hands-on users and the most proficient users forget what it is to be a beginner," Shu observes. "But user groups provide a safe place to ask dumb questions." Another advantage of these groups for architecture-specific programs, like DataCAD or ArchiCAD, Shu says, is that "all the participants are architects, contrasted with vendor support that typically comes from software developers." Most software vendors can provide lists of online and local groups related to their products. Membership is normally free.
Architects located in metropolitan areas have another option that is a hybrid of the in-house self-help and vendor or user support group: Independent support companies founded and staffed by technical people with architectural training. In Boston, New York, Los Angeles, San Francisco, Chicago, and other major centers of architectural practice, firms lacking a full-time technology support person or

With the booming demand for architectural services, staffing for technology management is emerging as one of the critical bottlenecks in design practice. As firms grow and evolve, architects will continue to face tough choices between hiring in a tight job market or nurturing in-house talent. Although architectural skill will remain paramount, mastery of job-specific technology will play an increasingly important

looking to supplement their in-house technical support capabilities can call on these support companies, such as San Francisco’s Tech Strategy Group (TSG).

As described by Principal Roy Lew, Assoc. AIA, TSG functions as a roving IT/IS support resource. Bay Area design firms contact TSG staff, wherever they happen to be, via cell phone or E-mail, and TSG responds by dialing in remotely to troubleshoot the customer’s system or, if need be, sending a consultant to the site. Lew, who also chairs the San Francisco AIA chapter’s computer forum committee, notes that most support specialists have prior experience as in-house IT or IS staff.

role in hiring and advancement for every design firm position, from the network system gurus down to the rank and file.

As formerly obscure computer techniques become mainstream, tasks that previously were farmed out are moving in house, while new specialties emerge. Few architects rely on service bureaus for word-processing, accounting, or general-purpose CAD, but many design firms still do go outside for 3-D rendering and animation or for advanced database and Internet programming. Over time, these new specialties also will be handled by the staff, requiring new hires, more training, and more intensive support in this iterative loop of advancing technology.

Don’t fall into the trap.

Some people have no choice. The design software provided in their workplace is illegal.

Even if it’s tempting to use a pirated copy of software like AutoCAD, it’s wrong. It hurts the people who work hard to make your software better, and it hurts you. Without a valid license, you can’t get the service and support you deserve.

Your company could even face legal problems. Even if it’s not your fault, you can do something about it.

Call for more information or to report pirated Autodesk software.

Don’t fall for it. Report it. All calls completely confidential.

1-800-NO-COPIES

© 1999 Autodesk, Inc. Design Your World is a trademark. AutoCAD and the Autodesk logo are registered trademarks of Autodesk, Inc. in the U.S. and other countries.

All other trademarks, product names and/or trade names are used solely for the purposes of identification and belong to their respective holders.