Intelligent Building Technology: The Evolution of the AV Consultant

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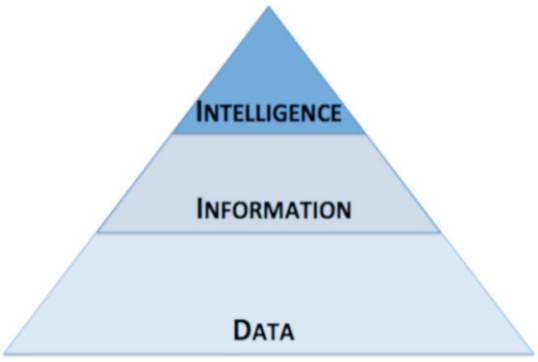
INTRODUCTION

As a firm that has offered audiovisual consulting for over two decades, Charles M. Salter Associates has seen building technology evolve from single-function, analog-based systems to the multi-function, networked systems offered today. As architects and other design professionals are faced with integrating increasingly complex systems within their buildings, they are aware of missed opportunities for smarter and better-integrated building technology, yet seldom know to whom to turn. This paper will inform architects, building owners, and other stakeholders how AV technology can contribute to smarter and more sustainable buildings. We will describe the AV system's role in intelligent building technology, look at important trends and systems, and discuss a real-world process for delivering more intelligent buildings.

Intelligent building technology (IBT) has evolved from the early computerization of building systems starting with the emergence of computer-controlled stand-alone systems (e.g., lighting, CCTV, elevators) and progressing to multi-function building systems (e.g., HVAC-based Building Automation Systems) and multi-function user systems (e.g., audiovisual-based room scheduling). However, complete integration between building systems and user systems has generally evaded the building industry.

Audiovisual consultants are involved with sight, sound, touch, and most importantly, the user experience. Perhaps more than any other discipline, they integrate disparate technologies to enable building occupants to do their work better. Technology integration is the essence of the intelligent building. By expanding their service offerings in other low-voltage technologies (e.g., telecommunications and security) and increasing their understanding of building systems in general, audiovisual consultants will continue to expand their role in the design of intelligent buildings.

INTELLIGENT BUILDING TECHNOLOGY DEFINED



Intelligent building technology is often used interchangeably with terms such as "smart" building or integrated building technology. So what is an intelligent building? To answer this question, it helps to understand the hierarchical relationship between data, information, and intelligence.

In modern buildings, an ever increasing number of systems generate a torrent of data. However, data alone does not achieve intelligence. Furthermore, each system's data is typically separate from other systems. To create truly intelligent buildings, these sets of data need to be integrated and processed to yield beneficial outcomes.

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From this understanding, intelligent building technology can be defined as the integration of building systems to promote better energy usage, worker efficiency, safety, wellness, and user experience.

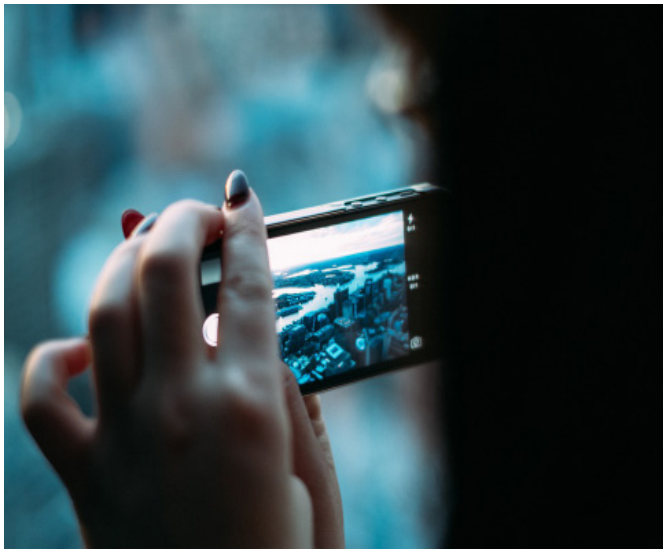
TRENDS TO WATCH

The intelligent building market is projected to grow at an annual rate of 28%[1] from 2014 to 2018. Advances in technology, convergence, demographics, and the trend towards "net zero" buildings will be drivers of this growth.

Convergence
Convergence, the growing trend of transporting, storing and manipulating digital audiovisual signals on computer networks, provides both challenges and opportunities for the AV industry. On one hand, these emerging technologies provide a new palette of solutions. On the other hand, these technologies increasingly commoditize what were once the domains of customized solutions. Faced with increasing commoditization and IT virtualization of their product lines, many in the audiovisual industry see intelligent building technology as the new frontier.

Wireless Mesh Networks
Intelligent buildings can be fitted with hundreds of sensors and actuator devices. Wiring and powering these devices can be difficult. Fortunately, wireless mesh network standards such as Zigbee (IEEE) and EnOcean (ISO) fill this gap. These standards use energy harvesting to power devices. As the name suggests, energy harvesting generates energy from the environment through photonics, motion, temperature gradients, or induction. With no wires or batteries, acquiring data anywhere within a building is made practical.

Wireless Mobility
Since the release of the iPhone 6, virtually every new mobile device now has both Near Field Communication (NFC) and Bluetooth Low Energy (BLE) capabilities. These wireless technologies can provide a new level of interaction between the building and the occupant. With NFC, merely "bumping" a phone against a building sensor will transmit personal data. Initial building applications for NFC include access control, occupant identification, point-of-sale, and other bring-your-own-device (BYOD) applications.



With BLE, low-cost Bluetooth Beacons can be located throughout a building to track occupant locations and capacities. So far, the applications for Bluetooth indoor positioning have been mostly limited to shopping malls and museums. New applications are sure to come.

Net-Zero Buildings
A current focus in sustainable building design is the "net-zero" building: a building that generates as much energy as it uses. To meet net-zero goals, building technology will be put on strict energy budgets with a trend towards consolidation, virtualization, and migration to the cloud. Large onsite telecommunications rooms will become a thing of the past, replaced partly or entirely by off-

[1] *IDC Energy Insights, 21 March 2014 Press Release*

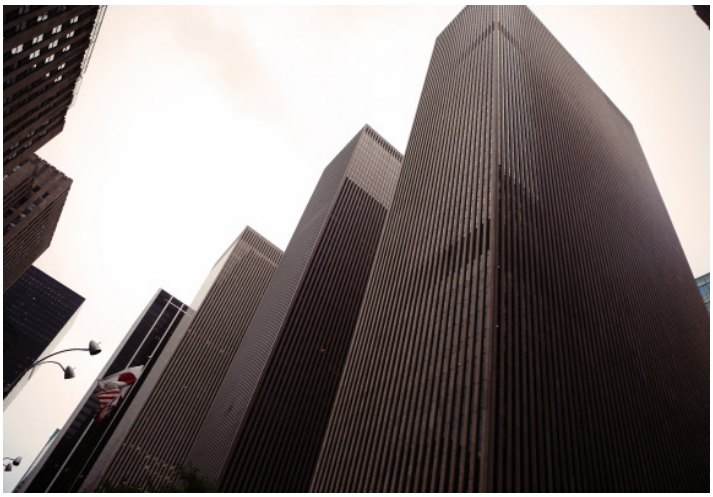
site cloud-based servers.

Big Data & The Cloud
Big Data is defined as data sets that are too large and complex to manipulate or integrate with standard methods or tools. Intelligent building systems and "smart" electrical utility grids will benefit from cloud-based Big Data technologies. A new industry alliance known as the Continental Automated Buildings Association (CABA) advances Big Data's application for building automation in both the residential and commercial markets. The range of its members - including Cisco, IBM, Honeywell, BMW, PG&E, and the U.S. Department of Energy - hints at a smart building future to come.

BUILDING SYSTEMS

Increasingly, audiovisual system designs are integrated with other low-voltage technologies such as data networks and security systems. This trend bodes well for improved technology integration within a building. Coordinating the many systems (including HVAC, lighting, security, fire alarm, irrigation, and energy monitoring) through custom software applications is required to achieve intelligent building technology.

Building Automation System vs. Intelligent Building Technology
Building Automation Systems (BAS) originated as HVAC controllers. They now control lights, shading, daylight harvesting, energy management, and life safety systems. BAS systems exhibit many of the characteristics of intelligent building technology. However, BAS systems alone fall short of meeting the user-centric experience that full implementation of intelligent building technology provides. Fortunately, audiovisual-based intelligent building technology can readily interface with BAS systems to take full advantage of occupant-generated data and behavior.



Networked Audiovisual Systems as an Intelligent Building Technology Host
Audiovisual devices became connected to the Internet nearly fifteen years ago. This breakthrough spurred manufacturers to develop software for managing and monitoring systems and other building assets. Audiovisual systems were used to schedule system power through calendaring systems such as Outlook. Notifications of projector lamp failures could automatically be emailed to service departments. These capabilities were later extended to control the entire room and enabled turning on lights, rolling down shades, and setting HVAC set points, before a scheduled presentation.

Today, the audiovisual system can control, monitor, and interact with a number of building systems including:
- Lighting, shading, and daylight harvesting
- Room scheduling
- HVAC set points

- Energy monitoring
- Security systems

Networked audiovisual systems have evolved into all-encompassing intelligent building system controllers. Today's audiovisual control systems communicate in both BACnet and Internet Protocol (IP), which are the predominate protocols of HVAC and other building systems.

Room Scheduling
Room scheduling systems work with calendaring systems such as Outlook or IBM Notes. These systems provide granular data tracking and back-end analytics on how meeting spaces are used. These analytics allow for better-managed facilities and even help plan new ones. Today, room scheduling regularly integrates with audiovisual controls and should be a part of any intelligent building technology system.

Plug-Load Monitoring
Plug-loads are electricity used by occupants from accessible AC outlets (excluding electricity used by HVAC, building lighting, IT, and AV systems). They can account for up to 20% of a building's energy usage. Reducing plug-loads is accomplished by procuring energy efficient equipment, proper equipment settings and most importantly, improving occupant behavior. AC current sensors at individual AC receptacles can be interconnected via wireless mesh networks to monitor plug-loads. This data can then be sent to energy monitoring and dashboard systems.

Energy Monitoring & Dashboards
Energy dashboards are digital signage that let occupants see the sustainability performance of their building, ranging from energy to water usage. Occupant behavior is improved when tenants monitor their resource usage and see positive outcomes from their day-to-day actions.

Credit: Aaron Leitz/Umpqua Bank

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INTELLIGENT BUILDING TECHNOLOGY PROCESS

The integration of building and user systems is complex and demands a process that provides greater collaboration. Many project delivery methods such as integrated design process (IDP), lean design, design-build, and BIM are suited for an IBT project. The low-voltage technology industry is formalizing a true process for implementing intelligent building technology.

A Step-by-Step Process for Intelligent Building Technology
Nearly a decade ago, the audiovisual industry campaigned to have sustainable technology initiatives included in the LEED® green building program's rating system. Unsuccessful at the time, a new and separate industry alliance was formed called the Sustainable Technology Environments Program (STEP), which includes its own rating system similar to LEED.

The STEP rating system never gained favor for building certification. However, STEP's body of work was recently adopted by Telecommunication Industry Association (TIA) as a basis for a new draft ANSI standard titled "PN-4994 - Standard for Sustainable Information Communications Technology."

This TIA document addresses sustainability issues in the design, construction, and occupancy of buildings, and most importantly, the implementation of intelligent building technology. It provides directives through all project phases, including identifying an IBT project manager, creating an IBT deployment matrix, and integrating room scheduling with other systems within the building. This document provides a road map for owners and design professionals to implement intelligent building technology.

CSI MasterFormat Division 25
Audiovisual and other low-voltage professionals are familiar with Construction Specification Institute (CSI) Master Format, Division 27 – Communications. Less well known is Division 25 – Building Automation. A designer can use this division for listing products and instructions to implement intelligent building technology.

Much like individual specification sections, this division is organized into three parts:
- 25 00 00 General
- 25 30 00 Products (e.g., sensors and receivers)
- 25 50 00 Execution

By using its six-digit numbering system, a specification writer can detail how systems within a building are to be integrated. Each system type is given a numeric "container" to list products and executable actions.

CONCLUSION

As the role of technology advances in people's lives, design professionals will continue to see increased demand for better integration between the building systems and the end-user. Although no single system or discipline provides a complete intelligent building solution yet, audiovisual technology and its design consultants will have an important role in making intelligent building a reality.

ABOUT THE AUTHOR

Ken Graven, Senior Vice President at Salter, has provided audiovisual, acoustical, and telecommunications design consulting services on over 500 projects spanning a 25-year career. An advocate of sustainable design, Ken believes that technology will be the key to solving many of today's challenges.

For more information, contact Ken at **kgraven@salter-inc.com**.

Salter, founded in 1975, consults in acoustics and designs audiovisual, telecommunications, and security systems for buildings. With offices in San Francisco, San Jose, Honolulu, and Seattle, they are involved in over 900 projects per year worldwide. Salter's team of more than 55 comprises Professional Engineers, LEED Accredited Professionals, Certified Technology Specialists, Registered Communications Distribution Designers, Fellows of the Audio Engineering Society, Fellows of the Acoustical Society of America, and a PhD, as well as individuals with interdisciplinary and advanced degrees in architecture, music, linguistics, business, and forensics. Salter draws from this diverse expertise to develop solutions tailored to each project.

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