Development of the King Abdul-Aziz Endowment Project

CASE STUDY OBJECTIVE

Traditional buildings have been beset by problems that are often considered the usual suspects in an IT setup such as security, robustness, manageability, reliability, maintainability and redundancy. The evolution of the Internet has resulted in the steady application of the convergence approach to effectively integrate and cost-effectively manage building automation systems and services resulting in increased savings and reduced capital expenditures.

In examining the intelligent technologies and features from CommScope's Intelligent Building Infrastructure Solutions (IBIS) at the King Abdul-Aziz Endowment Project, this case study demonstrates how a converged physical layer infrastructure provided operational excellence as well as ease in maintaining individual system functionality, minimized upfront costs due to labor and material savings, increased lifespan and durability and reduced maintenance costs resulting in various direct/monetary benefits. An additional benefit is the relative ease of future expandability involving minimal disruption, the result of which is a faster Return of Investment (ROI), better utilization of installed cabling and a lower total cost of ownership.

PROJECT OVERVIEW

BT Applied Technology (BTAT), based in Saudi Arabia with a growing global reach, specializes in providing software, hardware and building management integration using network technology. BTAT was the design engineer and technology integrator for the development of the King Abdul-Aziz Endowment Project.

From conception to planning and implementation to operation, BTAT was responsible for selecting and leveraging the cooperative efforts of companies involved in delivering an integrated network solution. In order to move away from the conventional physical infrastructure design to a more integrated approach, BTAT reached out to CommScope and it's IBIS solutions to help in the supply chain and product delivery of a converged physical layer infrastructure. The cabling design had to follow international industry standards with consistency of planning and implementation across subsystems and projects, making for a predictable and efficient workflow.

PROJECT OBJECTIVES

Capital expenditures (CAPEX) are expenditures creating future benefits. A capital expenditure is incurred when a business spends money to buy fixed assets or add to the value of an existing fixed asset with a useful life that extends beyond the taxable year. An

operating expenditure (OPEX) is an ongoing cost for running a product, business or system. It is a common understanding that the cost of communication wiring in an intelligent building project may be over 15 percent of the total cost, often caused by separate and proprietary cabling installed for several control systems and data communication. Ultimately, this translates into more CAPEX and significantly more post installation OPEX for maintenance and upgrades. The project was to reduce CAPEX and OPEX using a converged physical layer infrastructure using CommScope's IBIS solutions.

- Reduce CAPEX:
    - Converged physical layer infrastructure, consolidated cabling – all using Unshielded Twisted Pair (UTP) cabling, except Fire, Life, Safety (FLS) and Public Address (PA) system
    - Converged backbone versus a separate backbone for each separate system
    - Common containment space versus separate containment space if separate infrastructure had been deployed
    - Common data equipment to serve multiple systems versus multiple different equipment to serve each system
    - Installation costs are reduced based upon familiarity of the physical layer infrastructure used
    - Architecture allows for seamless introduction of new Internet protocol (IP) systems and solutions
- Reduce OPEX:
    - As many IP systems as possible – easier to manage
    - Easier remote access and monitoring via Web-based solutio
    - 12 IT people managing all IP systems in the following::
        - 11-story podium (that will ultimately support 7 towers) with commercial space
        - A 34-story tower
        - Two 44-story towers

FACILITY

Project name: The King Abdul-Aziz Endowment Project located in Makah, Saudi Arabia

Overall project size:

- Planned total of seven towers, the highest reaching 531 meters
- Towers range from 34 stories to 90 stories (four towers built and three towers to be built)
- Approximately 40 rooms per floor
- All towers sit on an 11-story podium that houses commercial space (Restaurants, shopping center, clothing stores, etc.)

Physical Layer:

- 9,000 kilometers of SYSTIMAX® Cat 6 UTP copper cabling
- 100,000 RJ45 outlets (all managed, using CommScope's SYSTIMAX iPatch® System of Intelligent Building Infrastructure)
- 10,000 kilometers of fiber
    - Single mode (fiber backbone)
    - Single mode & multimode (OM3) in the data centers

Space:

- Total built up area of 1.4 million m2
- Supports up to 75,000 tenants
- Two network operating centers (NOCs)
- Nine building distribution rooms (BDRs)
- 531 floor distribution rooms (FDRs)

RESULTS

The project resulted in a highly integrated intelligent building using a converged physical layer infrastructure.

IP everywhere solution:

- IP Telephony, IP Pay Phones, IP FAX, IP DATA, IPTV, IP ATM, IP Point-of-Sale terminals (POS), IP Access Control, IP Video Surveillance, IP Door Locks, IP Audio

- Digital signage - Advertising screens throughout the buildings, including in the elevators

CAPEX

- Estimated 33 percent reduction in cost due to avoiding redundant cabling and containment space (and labor, scheduling, commissioning, etc.)

OPEX

- One system administrator (IT) versus ratio of seven administrators (CCTV, Advertisement, TV, Public Address, Data, Access Control, and Telephone)

- Reduced cost in Operation Administration & Maintenance (OA&M) and Moves, Adds, and Changes (MAC) work using SYSTIMAX iPatch Intelligent Building Infrastructure behind every outlet

A building today utilizes many different systems, including (but not limited to) close circuit TV's, HVAC (heating, ventilation and air conditioning), advertisement displays, data networks, access controls, lighting control and telephones. In the past these various systems had their own administrator and took up a large amount of space. In the King Abdul-Aziz Endowment Project, these various systems connect on a grid and converge into a single integrated system. The key to integrating these systems is the facility's common IP backbone. The various systems are connected to the IP backbone enabling easy communication and control of the plethora of systems through what BTAT calls a unified outlet.

The ultimate goal of this project was centered on the Fourth Utility Concept. The first three utilities are water, electric and HVAC. IP, the fourth concept, is a new advancement for building technology. The fourth concept consists of IP-enabled systems over a common cabling infrastructure as the center for integrating telecom, office automation and building automation systems. This project set out to implement the Fourth Utility Concept in the integration of the building by reducing CAPEX through consolidation of all UTP cabling, except the fire/life/safety and the PA systems, and then reducing OPEX by using native IP and intelligent patching throughout the buildings.

To realize the Fourth Utility Concept through the integration of the different systems there needs to be materials within the infrastructure to support it. The towers contain 100,000 outlets, which are all managed using SYSTIMAX iPatch Intelligent Building Infrastructure with both copper and fiber cabling. There are 10,000 kilometers of fiber cabling containing single mode fiber backbones, single mode and multimode (OM3) fiber in the data centers, and 9,000 kilometers of SYSTIMAX Category 6 UTP copper cabling.

CONVERGED PHYSICAL LAYER INFRASTRUCTURE OVER IP

The evolution of the Internet, apart from spawning consumer Web powerhouses, also has resulted in the steady application of networking principles to integrate and manage building automation and management services across Wide Area Networks (WAN) and even Metropolitan Area Networks (MAN). Initially perceived simply as a passive purveyor of information, the Web has assumed an integral role in the functioning of enterprise tools such as Enterprise Resource Planning (ERP), Material Resource Planning (MRP), Customer Relationship Management (CRM), Remote Monitoring, Web Services and Cloud Computing. These and other customized tools have resulted in a significant increase in the exchange of dynamic data, redefining the way in which people interact with their IT systems.

The key components and benefits of a converged physical layer infrastructure and IP are:

- Easier deployment and commissioning of Building Automation Systems (BAS) using Ethernet/IP
- IP-based communications over Ethernet is replacing proprietary BAS interfaces and protocols
- Lower implementation cost
- Reliability and interoperable (LAN and WAN)
- Relatively simple to design, install and maintain
- Scalability: Ease of migration to higher data rates
- Familiar management tools and common skills base requiring minimal retraining when converged onto the IT infrastructure
- Provide lower operational and maintenance cost by using the Internet (via Web browser) as opposed to leased lines
- Logical and Physical addressing
- Ethernet is ideally suited for structured cabling
- Provides enhanced Quality of Service (QoS)
- Ability to encrypt voice, data and building system data as needed
- Additional fault tolerance due to TCP/IP stack services and higher layer services

IP convergence is becoming a reality and the days of separate voice and data networks are becoming a thing of the past. Adopting open system architecture and implementing ISO specifications, CommScope can significantly increase the lifespan of significant portions of

cabling infrastructure in a building obviating extensive changes or expensive upgrades, enabling various office systems like telecommunication systems, office automation systems, and building automation systems to dramatically minimize the cost of upgrades dramatically. These added functionalities result in simplified administration and maintenance processes which enable cost-effective responsiveness to increasing building and occupant needs.

Minimized upfront costs due to labor and material savings, increased lifespan and durability and minimal maintenance costs are various direct/monetary benefits that can be realized. By adding the relative ease of expandability involving minimal disruption, the logical outcome is faster ROI, better utilization of installed cabling and a lower total cost of ownership. Traditional buildings have been beset by problems that are often considered the usual suspects in an IT setup such as robustness, reliability, redundancy, security, manageability and maintainability. CommScope realizes this as an opportunity to achieve significant financial and operational benefits for building owners and managers.

IP BASED VERSUS TRADITIONAL SOLUTIONS

There are elemental differences between the employment of IP-based technology versus traditional technology in a building's infrastructure, data equipment, system operation and maintenance, installation cost, remote access and monitoring, compatibility, redundancy and future expansions.

- With respect to the physical layer infrastructure, the traditional approach requires separate cabling for each system, while IP allows for a single cabling solution for all systems.
- Data equipment is only used to serve the Internet with traditional systems, while with IP it can serve all the systems.
- In system operation and maintenance, a traditional solution uses one support team per system, but with IP there is one support team for all systems, which lowers OPEX.
- The installation and commissioning costs are higher for traditional solutions because of multiple subcontractors and vendors, and it is lower than traditional systems when using IP because there can be one system integrator.
- Remote access and monitoring would need extra equipment while lacking flexibility if a traditional solution is used, but with an IP-based solution it only uses a web-based solution.
- Compatibility varies from one vendor to another within traditional solutions through its use of proprietary technology, but there are open standards in IP solutions.
- Redundancy within traditional solutions varies from one vendor to another with its use of propitiatory technology, where IP solutions are fully redundant.

- The future expansions of a building using traditional solutions would necessitate new equipment, cabling and civil works, but an IP-based solution provides easy expansion and hardware upgrades and software.

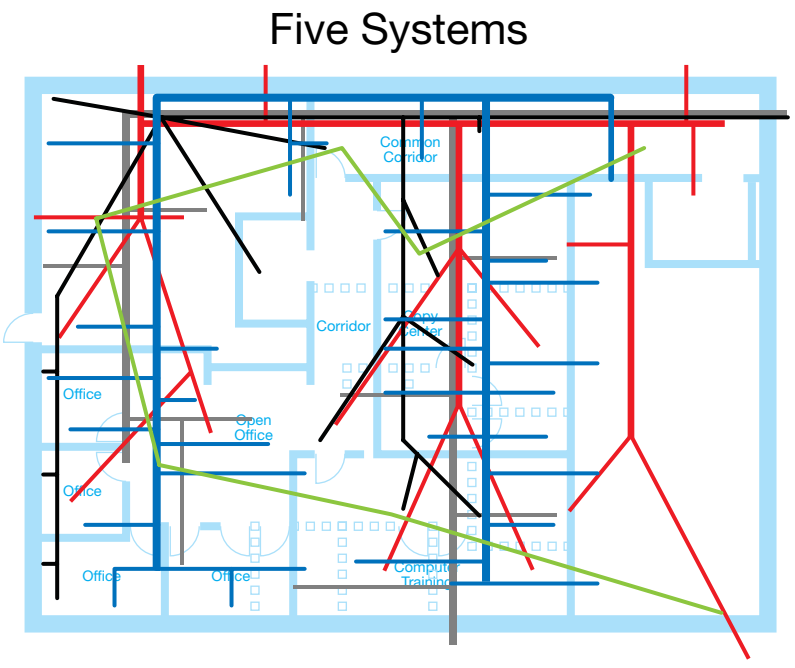
By consolidating/integrating cabling from multiple systems, material and labor inputs can be reduced, thus providing savings in initial construction costs. Empowering a unified team of professionals to implement the cabling process can reduce the time spent in project management.

COMMSCOPE INTELLIGENT BUILDING INFRASTRUCTURE SOLUTIONS (IBIS)

Traditionally, amidst all the typical gadgetry and high-tech equipment in a building infrastructure, cabling has been considered as another mundane element comprising the physical network. With the explosion of the Internet becoming an integral part of most buildings and the subsequent advent of video and multimedia content, video conferencing, telepresence and complex high-bandwidth applications, buildings increasingly require more robust communication infrastructures. By integrating HVAC, lighting, video surveillance, access control and other integral components, the management and maintenance of these systems have become vastly simplified. This integration, however, has brought to the forefront the vulnerability of the underlying infrastructure.

In a typical large building, there are multiple low voltage systems, which may seem a nightmare for the average IT/ facilities manager. As shown in Chart 1, the plethora of cabling for HVAC, fire, life safety, security, voice and data, and paging alone can contribute a great deal of complexity to a building's cabling infrastructure.

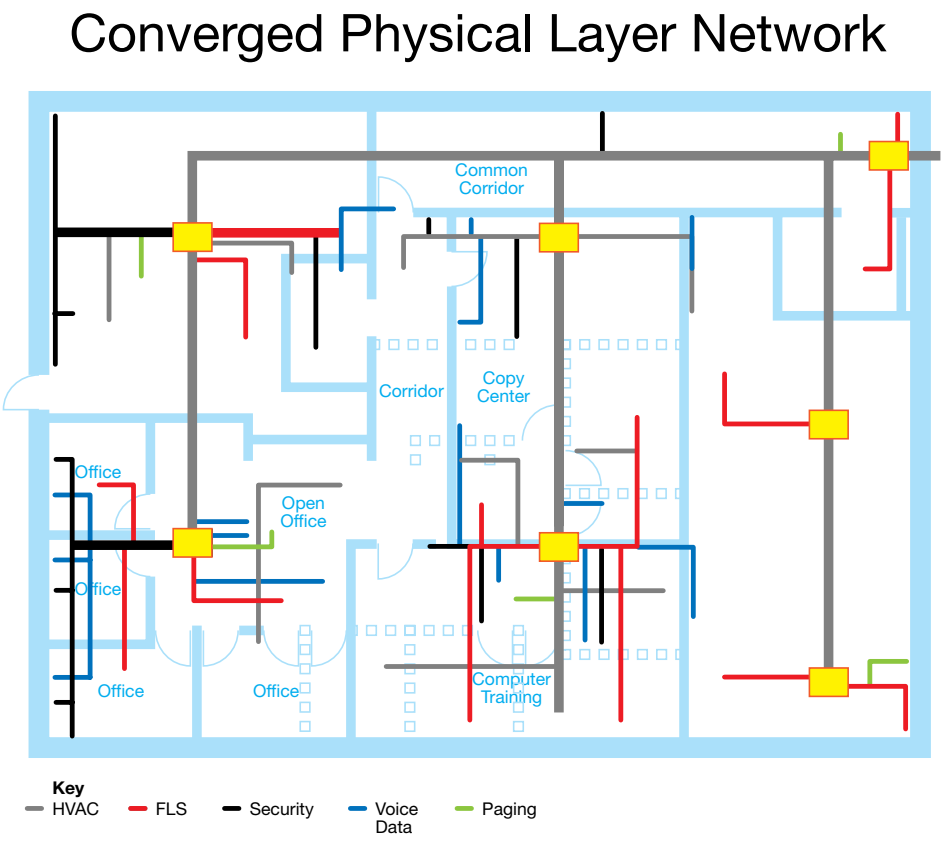
Chart 1 - Building Cabling Wiring Showing a Typical Super-Imposition of Five Cabling Systems



In the example, each cabling system is seperately installed by different contractors not coordinating or collaborating together upfront. This frequently leads to expensive redesigns and time consuming changes throughout the building's life cycle.

In contrast, as seen in Chart 2, an IBIS system provides the same level of connectivity with much lower complexity in installation, maintenance and redesign/modification. This ease of operation generates substantial savings and makes a strong business case for building owners and managers to consider such options based on first cost and lifecycle costs.

Chart 2 - Building Cabling Diagram Showing an Intelligent Building Infrastructure Solution (IBIS) Implementation



Engineers involved in maintenance or modifications to building wiring infrastructure understand and value the facts that maintenance windows are shorter than ever, and any change to the network must be made quickly and accurately. Considering the impact of network outages on the productivity of internal customers or external interfaces like transactional web sites for the general public or customer-focused intranet, any change or modification has to be right the first time, every time. When downtime can cost millions of dollars per hour and the subsequent potential loss of goodwill and reputation, it is imperative to minimize the possibility of any connectivity related downtime.

CONSIDERING A ROBUST BUILDING INFRASTRUCTURE

Seamless access to the corporate network is necessary for today's corporations, and this inevitably makes various MAC demands on the network. To ensure valuable time and resources are not lost, misplaced or misused, significant effort and manpower resources are required to administer them. Typically any MAC changes prompts questions for the engineers/technicians like:

- Are you in control of your network infrastructure?
- How many hours are consumed chasing down the unknown?
- Can you report switch capacity accurately?
- Are you in compliance with IT policies and other regulations?
- Can you prove it?
- Do even simple changes cause downtime? How quickly can you recover?
- How much does it cost to do an annual audit? Do you know?

Satisfactory response to such questions realistically depends on the infrastructure the building owners, managers and engineers have in place in their buildings. Dealing reliably with system and component failures when compared to existing solutions is very important as conventional techniques fail to provide effective resolution and are incapable of problem isolation. The solution has its roots in areas such as ensuring sufficient redundancy in cases where individual controllers can work even after a loss of communications with the main controller, enhancing design-tool integration and developing effective automated diagnostic tools. This is an area where SYSTIMAX iPatch Intelligent Building Infrastructure solution excels.

To successfully overcome the concerns and meet the efficiency objectives facing IT and facility managers, the right solutions need to be focused on addressing the following challenges:

- Bandwidth capacity
- System robustness
- System reliability
- Network security
- Network manageability
- System and network maintainability

Revenue generation from properties depends on these critical capabilities, and has to be a top priority for people responsible for making certain every asset has a positive impact on the bottom-line.

CONSOLIDATED ENTERPRISE IT NETWORKS

Enterprise IT networks need to be agile and nimble to cope with the rapid pace of change associated with organic growth, acquisitions or implementation of new applications. As corporations expand, bandwidth capacity, reliability and security of the infrastructure become potent issues that require thoughtful consideration. The SYSTIMAX iPatch Intelligent Building Infrastructure System can empower IT and facility managers with the visibility and control over their network, reducing scheduled and unanticipated downtime, increasing revenues by incorporating high-speed applications and increasing productivity with better management of MACs. Consolidation drives the need for quick, accurate changes along with more effective planning tools. As more computing power and storage is concentrated in mission-critical data centers, reliability, availability and security become paramount.

INTEGRATED STRUCTURED CABLING INFRASTRUCTURE

A converged physical layer infrastructure can lower construction costs, optimize operational expenditures and eliminate dealing with multiple contractors while simplifying the installation process to minimize potential system conflicts and reduce implementation timelines.

Benefits resulting from consolidation of the structured cabling in a construction or retrofit project are:

- Operational efficiencies
- Reduced infrastructure materials
- Reduced maintenance
- Increased productivity
- Real-time reports and monitoring

By consolidating/integrating cabling from multiple standalone systems, material and labor inputs can be reduced, thus providing savings in initial construction costs. Empowering a unified team of professionals to implement the cabling process can reduce the time spent in project management. Integrating various systems to reduce complexity can enable quick service provisioning for occupants and tenants resulting in ease of maintenance and configuration of various outlets and ports.

Facility owners would take advantage of lower financing costs because of a faster occupation rate as a result of faster commissioning. Also, facility owners can typically command a premium on rent based on the ease and flexibility afforded by the infrastructure in deploying technologies to suit customer needs. In addition, by following and implementing industry-approved standards, outlets are standardized to simplify upgrade opportunities. Standardization also ensures multi-vendor compatibility, thus promoting competition between various suppliers resulting in price competitive product or solution offerings. Furthermore, by adopting zone-based architecture (as supported by the TIA/EIA 862 standard), BAS equipment can be centralized to optimize location spaces.

Another major advantage to zone-based architecture is that it's application independent and expansion-friendly. If there are changes in building usage resulting from tenant mobility or re-layouts, a minimal amount of cabling is removed thereby restricting the disruption, the subsequent wastage and hence containing the cost.

INTELLIGENT BUILDING INFRASTRUCTURE SOLUTIONS

As technology and connectivity demands continue to spiral, communication infrastructures need to become more intelligent and robust to accommodate these changing needs. An intelligent infrastructure solution provides the foundation to a reliable and high-performing communication infrastructure and a strong backbone to power the lifeline of an enterprise. The solution delivers a complete end-to-end physical layer solution, including cables and connectivity, enclosures, intelligent software and network design services for business enterprise applications. Typically, cost of communication wiring in a building automation project may be over 15 percent of the total project cost.

The converged physical layer infrastructure at the The King Abdul-Aziz Endowment Project demonstrated how a converged infrastructure provided operational excellence as well as ease in maintaining individual system functionality, reduced CAPEX by approximately 33 percent, increased lifespan and durability, and minimized OPEX by lowering maintenance and administration costs. By adding the relative ease of future expandability involving minimal disruption, the logical outcome is faster ROI, better utilization of installed cabling and a lower total cost of ownership. The advantages of these IP-based solutions allow for efficient integration within the building while also providing for easily executed future expansions and improvements.

CONCLUSION

In addition, to all the other benefits outlined in this case study, a converged physical layer infrastructure is a greener approach to cabling new buildings and retrofitting existing buildings. The green benefits achieved from this approach are:

- Reduced infrastructure materials
- Faster installation, fewer contractors, less site disruption – smaller carbon footprint
- Reduced maintenance – smaller carbon footprint
- High recycle content (copper)

This case study demonstrated how BT Applied Technology and CommScope brought a new approach to intelligent building infrastructure design by converging a building's many systems, from security to lighting to communications, onto a common infrastructure backbone. This convergence approach to network infrastructure, offered through the SYSTIMAX brand of offerings enables building owners to more efficiently and cost-effectively manage building operations resulting in increased savings and reduced business expenses.