WHITE PAPER

Cabling for IP Convergence

ADC®

Cabling
for IP Convergence

The introduction of the Internet in the mid 1990s revolutionized the telecommunications industry. Voice, data, video, security, and building management systems that once operated as separate analog systems have now become digitally based, allowing all forms of communication traffic to converge over a common infrastructure using Internet Protocol (IP) technology.

IP converged networks offer several advantages, all of which result in significant cost savings. At the same time, distributing and managing these systems over a common infrastructure means that today's networks contain more cabling than ever before, and data centers must evolve to support a multitude of mission-critical applications. The result is a need for ample and properly managed cabling pathways, strategic cabling solutions, high-density data centers, and superior reliability. This white paper covers IP convergence, its affect on network cabling, and cabling strategies and solutions aimed at supporting, managing, and leveraging these next-generation IP networks within the enterprise.

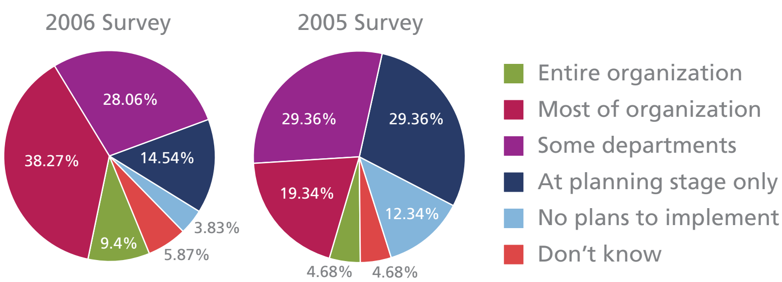
IP convergence simply implies the transmission of voice, video, data, and images for a variety of systems over a common infrastructure using IP packet switching technology. IP is the most widely used protocol across the globe, providing a standard format for transmitting several types of information over all interconnected networks that make up the Internet.

The shift to IP converged networks among today's enterprises is rapidly increasing as companies are beginning to see their true value. A 2006 study by the Economist Intelligent Unit for AT&T found that nearly half of senior executives have implemented IP convergence, nearly double the number recorded in the 2005 survey.

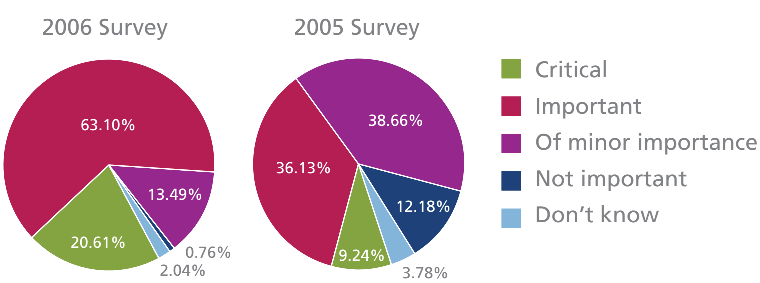
Bringing Systems Together

As the common protocol for communicating data across packet-switched networks and the Internet, IP is being used for an increasing number of applications. Business applications that run on IP networks are popping up everywhere, and the possibilities are virtually endless. From voice, data, and security to building management and even industrial systems, IP is bringing systems together over a common twisted-pair cabling infrastructure for improved data sharing, manageability, and cost savings. Following are some of the key applications converging via IP in today's enterprise networks.

Where IP convergence has been implemented in business



Importance of network convergence
to achievingorganizational strategic IT and business objectives



Source: Economist Intelligence Unit/AT&T surveys, June 2006 and June 2005.

Voice and Data

In the mid 1990s, the telecommunications industry began to recognize the advantages of migrating voice to digital by moving from circuit switched standard telephone service to sending voice as IP data packets over the Internet. This concept, known as voice over IP (VoIP) allowed users to avoid the cost of long distance charges and use the same cabling for both voice and data.

VoIP has evolved significantly and usage has expanded with most of today's companies deploying the technology. In addition to no longer needing separate cabling and paying for long-distance calls, VoIP systems are more scalable and less expensive because they are based on software instead of hardware. VoIP also enables mobility because calls can be made anywhere there is an Internet connection.

Companies implementing IP convergence can gain significant benefits. Running all applications over the same cabling simplifies network management, improves network scalability, and offers considerable cost savings. Following are the key benefits that IP convergence provides:

- Offers faster, cost-effective deployments and reconfigurations
- Eliminates the need to build and maintain separate networks
- Leverages existing infrastructure and investment
- Improves overall reliability of systems
- Provides better scalability to accommodate growth
- Facilitates management via centralized administration

Surveillance and Security

Traditional CCTV (Closed Circuit Television) systems were based on analog camera systems with a separate infrastructure of coaxial cable that transmitted video from cameras to recorders. With the introduction of digital video, analog image streams were converted to digital format for storing and management on digital video recorders (DVRs). This eliminated the need for magnetic tapes, improved video quality, and allowed video to be viewed from remote locations over the Internet. The advent of digital video eventually resulted in the introduction of IP-based cameras that also use twisted-pair cabling to transmit video anywhere on the network.

Traditional physical security systems that include door locks, motion detection, and access control are also starting to move towards using IP over twisted-pair.

This allows the transmission of alarm and access control information over the network in addition to video, enabling multi-site companies to remotely manage security systems for all buildings from one location. The advent of IP-based security systems is also paving the way for advanced software applications that can combine and analyze security information from a variety of devices. For example, systems can analyze video in conjunction with information from an access control keypad to ensure that the correct person is entering a building.

Intelligent Building Management Systems

In additional to voice, data, and security, buildings have several other systems that include lighting, HVAC, (heating, ventilation, and air conditioning), water systems, time clocks, and more. Today, many of these systems are automated through an intelligent network of electronic devices that monitor occupancy, temperature, and usage with the ultimate goal of reducing energy and maintenance costs. With intelligent building management systems (IBMS), facilities can be controlled to provide heating, lighting, air conditioning, hot water, and other services only when needed.

Many building automation systems (BAS) have migrated to digital and are beginning to take advantage of a common twisted-pair cabling infrastructure using IP. This makes information from devices easily exchanged between sites for centralized management and easily shared by applications for better analysis and control. In recent years, building construction has taken steps towards "smart" or "green" buildings that further reduce impact on the environment. Many of these buildings contain specialized systems that capture and control rainwater for use in flushing toilets or cooling systems, or support solar panels that decrease dependency on the electrical grid. IP convergence is making it possible to measure and evaluate data from these systems over the network.

Industrial Applications

Until recently, machines used in industrial applications communicated using several possible proprietary protocols. With the growing use of computers on the factory floor and the need to use manufacturing data for business planning, many are now seeing the advantages of using Industrial Ethernet over a common twisted-pair cabling infrastructure to support industrial applications. The benefits over previous protocols include increased speed and performance, increased distance, ability to use standard equipment, interoperability, and the integration of automation with enterprise and manufacturing resource planning applications (ERP/MRP).

The Affects on Network Cabling

As IP convergence continues to grow, the need for separate networks using various cable types decreases, greatly impacting the twisted-pair network cabling infrastructure as we know it today. With IP convergence, networks must support an increased amount of twisted-pair cabling and connections, new environments, extended distances, high-density data centers, and superior reliability. IP converged networks therefore require careful planning to ensure maximum space in pathways and data centers, protection in harsher environments, the ability to reach outlying devices, and maximum reliability. It's important to understand these issues and the strategies and solutions needed for supporting and managing IP converged networks.

Supporting More Cabling

As the number of systems converging over a common infrastructure grows, networks are seeing a rapid increase in the amount of twisted-pair cabling in pathways. Cable pathways in hallways and within the data center must be properly sized to accommodate more cabling while also enabling adequate cable management and room for growth.

When too many cables are routed in a single cable tray, tracing individual cables becomes extremely difficult, there is no room for adding more, and the probability of damage to the cable increases. These concerns can eventually lead to difficult reconfigurations, costly upgrades, and degraded network performance. It's therefore important to follow specified cable fill rates based on the overall cable diameter and cross-sectional area of the pathway.

Smaller cabling diameters can go a long way in saving costly pathway space for IP converged networks. Smaller diameter cables means that more cables can be supported in a single pathway without exceeding proper cable fill rates. ADC's TrueNet® Category 6 plenum cable features patented AirES® technology that incorporates channels of air within the cable insulation that run the length of the cable and reduce the amount of material for an overall smaller diameter, saving as much as 32% of the available space in cable runs. The smaller diameter of TrueNet cable also saves space in the communications closet and data center, reducing the amount of cable management accessories required.

For companies looking to implement the highest-speed twisted pair cabling to future proof their IP converged networks, ADC has the smallest 10 Gigabit twisted-pair copper cabling on the market. By further enhancing the AirES technology, ADC has reduced the outside diameter of its CopperTen® Augmented Category 6 UTP cable to 0.275” compared to the industry average of 0.310”. This translates into a 22 percent reduction in cross-sectional area, reducing installation costs due to lighter weight and improving fill rates in trays, conduits, and raceways for IP converged networks.

Combustibility and toxicity have long been an industry issue, and as more and more cable is deployed in plenum or air-carrying environments to support IP convergence, safety concerns continue to trouble network installers and users. To address this issue, many users are specifying limited combustible cabling (CMP-50) that goes beyond the basic plenum requirements. Through the use of AirES technology, ADC is able to deliver TrueNet Limited Combustible cable that actually exceeds CMP-50 standards. Since AirES cables require less insulation material within the cable itself, there is less material to burn. Less fuel means less smoke and less toxicity in air-return environments.

ADC's Catagory 6 Cable with AirES Technology

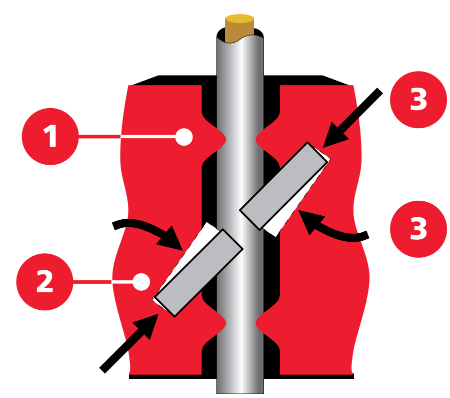
Competitor's Catagory 6 Cable

Spanning New Environments

With IP convergence, gone are the days when twisted-pair cabling supported only data connections throughout the open office environment. Now network cabling is making its way into other areas of a facility to support security, building automation, and industrial applications. As a result, cabling is being subjected to various environmental conditions outside of the premise environment. For example, cabling may need to reach security cameras in outdoor locations and machinery out on the factory floor. This makes it more imperative to select twisted-pair cabling and components that can withstand outdoor elements or higher temperatures.

ADC offers several solutions for to withstand the various environments of IP convergence. ADC’s Outback cable for outdoor use combines the AirES technology, excellent transmission performance, and weather resistant properties for use in buried conduit or aerial applications. The core of Outback cable contains a water blocking tape that isolates the core from moisture.

For industrial applications out on the factory floor, our TrueNet Limited Combustible cable offers a higher temperature rating to ensure reliable performance in high-temperature environments. Connections on the factory floor can also be subjected to corrosive environments and vibrations. ADC’s patented LSA-Plus® insulation displacement contact (IDC) featured on all TrueNet modular jacks, patch panels, and termination blocks includes silver-plated angled contacts positioned at 45-degree angles across the axis of the wire, making a solid, gas-tight connection. The LSA-Plus insulation clamping ribs grip wires securely and isolate the contact area from vibration and mechanical stress while the silver-plated design eliminates the possibility of corrosion out on the factory floor. The LSA-Plus technology, found on all TrueNet modular jacks, patch panels, and termination blocks, provides the most reliable, stress-resistant connection available in the industry.



ADC's LSA Plus Technology

1. Insulation clamping ribs hold the wire securely – isolating the contact area from vibration and mechanical stress.
2. Silver-plated contact tags at 45-degree angles across the wire’s axis make a solid, gas-tight connection.
3. Axial and torsional restoring forces make a solid, gas-tight connection.

Extending Cabling Distances

IP convergence requires the network to reach a variety of devices ranging from security cameras, access control panels, door locks, thermostats, and more. The horizontal distance limitation for twisted-pair cabling from the closet to the device is 100 meters. For typical office connections, maintaining that distance limitation is not typically a problem. However, now that cabling must reach outlying devices for security and building automation systems, it becomes much more difficult for designers to maintain the 100-meter distance limitation.

One strategy for reaching outlying devices is to ensure that a network telecommunications room (TR) is always within 100 meters of every device, which requires proper planning and design. Unfortunately, implementing a TR within 100 meters of every door lock, thermostat, or camera is not always the most cost-effective option. Telecommunications space is expensive, and having several TRs spread throughout a facility means IT personnel have more decentralized spaces to manage.

Extending the reach to outlying and remote devices located at distances greater than 100 meters from the TR can be easily accomplished with the use of fiber optic cabling and media conversion technology. Fiber optic cabling supports transmission of data to distances of 550 meters or more, depending on the application and fiber type. The use of media conversion at both ends of a fiber link is a cost-effective method for converting electrical signals to optical signals at the device and back to an electrical signal at the TR.

ADC's OptEnet™ Optical Extension Platform includes a variety of media conversion cards for converting optical signals from various fiber types to electrical signal for transmission over twisted-pair cabling. OptEnet cards are available for alarm applications, 10/100 Mb/s Ethernet, gigabit Ethernet, and optical regeneration for extreme distances (15 – 40 km range). Alarm OptEnet cards can also be daisy chained for connecting up to four devices via one IP address. For the TR end, the OptEnet Platform includes a modular chassis that accommodates up to 12 or 14 multiple types of OptEnet cards in two rack units or up to 4 cards in one rack unit. Media conversion is also ideal when fiber optic cabling is needed to eliminate the effect of EMI/RFI in noisy environments like the factory floor.

Designing High-Density Data Centers

One benefit of IP convergence is no longer having to deploy and manage separate networks and data centers for various systems. Environmentally controlled real estate is expensive, and it is not cost-effective or efficient to maintain redundant power and proper cooling in several locations. Supporting all IP converged systems in one properly designed data center also provides centralized management and monitoring, better security, a reduction in the amount of equipment and components, and standardization across systems. On the other hand, a decentralized approach is inefficient, leads to higher operating costs, and can cause inconsistencies and errors.

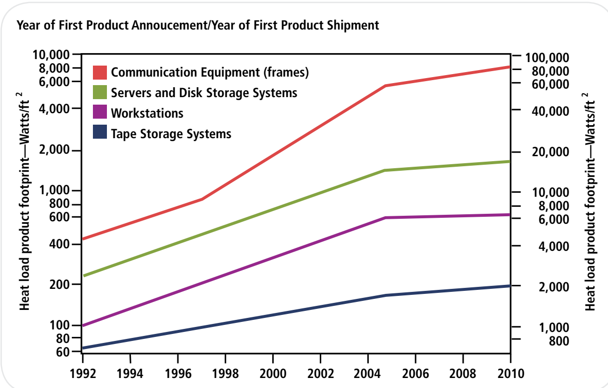
While server virtualization and blade servers are helping to consolidate the amount of equipment needed in the data center to support IP converged applications like voice, data, video, security, and building automation, the amount of cabling, connections, and storage increases dramatically. Data centers must therefore be designed with ample space and high-density solutions for both current and future systems while ensuring easy manageability.

In addition to saving space in cable pathways with smaller diameter TrueNet cabling, ADC offers a variety of cable management solutions that allow IT managers to maximize the number of data center cables and connections in a given footprint while providing easy access and protection. For copper systems, ADC's Ethernet Distribution Frame (EDF) forms a central patching location between active elements in the data center for quick modifications and reconfigurations without service disruption. With the EDF, permanent connections protect equipment cables while the Glide Cable Management system maintains protection and manageability of patch cables and doubles density by eliminating the need for horizontal cable managers. ADC's Optical Distribution Frame (ODF) protects fiber connections and maximizes the number of fibers in a given space while the FiberGuide Management System physically separates, protects, and routes fiber.

Enhancing Performance and Reliability

With IP convergence, network downtime no longer means that employees just lose access to email, data, and the Internet. Because data centers now support mission-critical systems like physical security and building automation, downtime can cause a life safety situation and simply cannot be tolerated. The performance and reliability of a IP converged network must therefore be the best it can be, which means implementing proper power and cooling for equipment, selecting the most reliable cable and connectivity components, and ensuring quick and easy deployments and reconfigurations.

As more systems are supported by a common IP infrastructure, more equipment is being deployed in data centers, and much of today's equipment is getting smaller and more powerful to save space. The result is a significant increase in the amount of heat generated by equipment in the data center. To ensure reliability of equipment, adequate primary and backup power and cooling systems become extremely critical for data centers of IP converged networks. ADC's high-density connectivity solutions can also help conserve cooler space for active equipment.



The Uptime Insitute Measurement of Heat Load

Because 70 percent of network downtime is attributed to failures at the physical layer, only the best performing cables and connectivity equipment will do for an IP converged network. From jacks, patch panels, and cabling to media conversion, power over Ethernet, and cable management solutions, all of ADC's cable and connectivity components offer best-in-class performance and are engineered for uptime while providing ease of deployment and reconfiguration. Built and tested in ADC's world-class facilities, TrueNet cabling and connectivity solutions are backed by a 20-year performance and applications warranty and the industry's only true Zero Bit-Error Warranty that guarantees signal integrity and throughput.

For more information on ADC's solutions and deploying and managing infrastructure for IP converged networks, please see the following:

102505AE – TrueNet Capabilities

102261AE – Three Principles of Data Center Design

102264AE – TIA-942 Data Center Standards Overview

105455AE – Managing Density in the Data Center

1296849 – Myths about Media Converters

102944AE – Data Center Infrstructure Design

103842AE – It's in the Science

WHITE PAPER

Website: www.adc.com

From North America, Call Toll Free: 1-800-366-3891 • Outside of North America: +1-952-938-8080

Fax: +1-952-917-3237 • For a listing of ADC's global sales office locations, please refer to our website.

ADC Telecommunications, Inc., P.O. Box 1101, Minneapolis, Minnesota USA 55440-1101