STRUCTURED CABLING CONVERGED APPLICATIONS IN BUILDINGS

SHEET 1

COMMUNICATION NETWORKS



INTRODUCTION

In recent years, communications have taken on a crucial role in development for businesses. Communications systems must provide efficient management of ever-increasing data flows, coming from different sources (office applications, e-mail, other software packages, video material, etc.).

The current trend in addressing this problem consists of making all these systems converge in a common network language and a single cabling infrastructure.

IP telephony and cabled, Wi-Fi and PoE computer networks - what does the use of these applications and functions entail? What criteria should be applied?

These are questions that will be answered by this review of IT cabling (cabling for information technology systems), and structured cabling solutions.

CONVERGENCE AND IP

CONVERGENCE

This is a term used to cover a reality that has become increasingly palpable as data exchange has become easier. IP (Internet Protocol) has made a major contribution to standardizing data exchange rules and formats. In a building, convergence means unification of networks, communication systems (computer and telephony), security systems and building management on the same medium.

Having initially been independent of the other systems of the company, video surveillance systems are converging increasingly with IP networks such as computer or telephone systems.

PROTOCOLE IP

Regardless of the communication medium used (twisted pair, fiber optics, wireless, etc.), IP (Internet Protocol) defines the simple and highly standardized communication rules that allow any of the items of equipment or systems to communicate with each other.

Although twisted pairs require conversion for analog systems, they are a favored medium for these two types of installation.

In the next five years, FULL IP technology should reach almost half of the video surveillance market. It is therefore necessary from now on to plan an appropriate infrastructure for this migration.

COMPUTER NETWORKS

WHICH CABLES FOR WHICH THROUGHPUT?

Since the boom in computer use for office applications in the 90s, companies have come to consider their networks as the heart of their communication systems and aim to obtain an increasingly high throughput.

The computer network has become the main support to company productivity and profitability.

In addition, if it is accepted that 50% of slowdown or loss of connection problems are directly or indirectly related to an aging or failing infrastructure, then it is undeniably important to make the correct choices from the start. Throughput required, availability rate, cabling environment and planned lifetime – these are some of the operating requirements to be taken into consideration.

Computer networks operate according to a simple principle: The higher the bandwidth, the greater the throughput. Bandwidths for copper cables on networks are expressed as categories and those of fiber optics as indexes.



STRUCTURED CABLING CONVERGED APPLICATIONS IN BUILDINGS

PERFORMANCE MAIN LEVELS AND APPLICATIONS

Туре	Cable Category	Maximum Bandwidth	Maximum Link	Applications			
Copper twisted pairs cable	50	100 MHz	100 m	From 10Mbits/s to 1Gbits/s on Ethernet protocols			
	5	250 MHz	100 m	From 10Mbits/s to 10Gbits/s * on Ethernet protocols			
	59	500 MHz	100 m	From 10Mbits/s to 40Gbits/s ** on Ethernet protocols			
Optical fiber	602	500 MHz*Km	550 m From 10 Mbits/s to 1Gbits/s on Ethernet protocols enables 10 Gbits/s on 86 m				
	em -4	4700 MHz*Km	550 m	From 10 Mbits/s to 10Gbits/s on Ethernet protocols, enables 40 and 100Gbits/s on 125 m			
	os2	Endless	10 000 m	From 10 Mbits/s to 100 Gbits/s on Ethernet protocols			

* on condition that an excellent quality of cabling is used

* * study in progress

PAY ATTENTION TO ELECTROMAGNETIC INTERFERENCE

With more than a billion computers operating in the world and this number predicted to reach 2 billion in 2015, network density will continue to rise. Computers, servers, hard disks and other items of computer equipment are highly sensitive to electrostatic discharge.

In an office environment, the main source of interference is the cabling itself. To protect against it, it is necessary to use shielded cabling solutions. These guarantee bandwidth integrity and constant throughput. Fiber optics are completely insensitive to electromagnetic interference.

A COMPLETE AND GUARANTEED CABLING SYSTEM

A COMPLETE AND GUARANTEED CABLING SYSTEM The cabling system is the combination of the cable, RJ45 connectors and RJ45 end cords. The use of components with equivalent performance levels and certified by an independent laboratory is advisable to maximize site lifetime. The cabling and its operation can therefore be guaranteed for a 25 year period.



STRUCTURED CABLING

EQUIPMENT TO FACILITATE OPERATION AND MAINTENANCE

For computer systems, the patch panels must allow maintenance and other interventions to be performed rapidly and efficiently. It is therefore preferable to use items of equipment that are easy to mark for identification.





MK6PAN1U Patch panel with color coding and reversible label holder

CORD6ASO1LED RJ45 cord with light-up identification

TELEPHONE NETWORKS

There are still two coexisting technologies: traditional telephony and IP telephone systems.

Traditional telephone systems are based on a PABX which provides the relay between the various people within the company. The PABX also takes control of external communications, managing voicemail and line grouping for call centers, for example.

In this case, the telephones operate on a pair (4/5 contact) and are generally managed over a dedicated network of minimum category 3 with a maximum bandwidth of 16MHz.

IP telephony (ToIP or VoIP) is based on IP for carrying voice using data frames. With this technology, management of IP PABX type equipment is standardized and the network used is shared with the computer system. This is generally the first step towards real convergence. This very simple administration mode makes it possible to assign an IP address to each handset and to provide precisely defined management, facilitating video conferencing or mobility within the building, for example.

Remote powering (PoE protocol) of telephones greatly simplifies the process of deploying and installing new workstations.

CONNECTION CABLE LENGTH - A SELECTION CRITERION?

Over the current twisted pair cables, the traditional telephone system can be transmitted up to 600 meters without amplification because it encodes the voice signal at very low frequency and is therefore not really subject to significant loss levels.

Conversely, an IP telephone system operates on the basis of the same principle as a computer network and is therefore subject to the same length requirements, i.e. 100 meters maximum. But because the cabling is currently calibrated for computers, and telephones are generally located close to computers, this does not constitute an impediment to a full IP solution.

WHAT IS THE MINIMUM CATEGORY FOR VOIP?

The throughput required by VoIP is actually very low, at just a few Mbits/s. However, as use of video conferencing or conference call services is increasing, fairly high bandwidths may be required in the future. Category 6 is turning out to be the minimum choice especially as cables of category 5e are in AWG24, and therefore not so well suited to the remote power feeding needed for IP phones.



THE QUALITY OF THE CORDS, THE KEY TO SUCCESS

Often, telephone cords are the cause of malfunctions.

In a traditional telephone system, the compatibility problem between the RJ11 connector of the telephone cord and the RJ45 wall socket creates breaks in voice transmission. There are RJ45 sockets adapted to RJ11 format available on the market. The other aspect concerns the use of cords with 1 pair or 2 pairs on 'standardized' cabling, making it thus proprietary to the telephone system.

But even with a standard telephone system, it is now necessary to use 4-pair RJ45 cords and category 5e at minimum.

With an IP telephone system, cord quality is crucial to allow transmission of low-frequency signals without causing any heating.

Copper-clad aluminum (CCA) cords must not be used because they are not compatible with the remote power feeding of handsets (PoE protocol). Their very high resistivity can also create real problems, to the point of making communication impossible over long-distance connections.



CCA CONDUCTOR 85% aluminum 15% copper 63% more resistivity 63% shorter length



COPPER CONDUCTOR 100% copper Length 100% in accordance with ISO 11801 standard

Multimedia Connect offers different qualities of cords to best fulfill your requirements. All cords provided by Multimedia Connect are made of copper.

WI-FI NETWORKS

Computer networks, by definition, can be wired or wireless of 'Wi-Fi' type. Wi-Fi access points, created to meet a mobility requirement within the company in particular, as an extension of the company network, are systematically connected to the wired network to be supplied with data. This Wireless Structured Cabling System requires some precautions, particularly in the case of high throughput wireless networks, like 802.11n.

There are three main problems for cabling Wi-Fi access points: incoming data cable performance, immunity to interference and capacity to take on the PoE protocol.

REAL THROUGHPUT vs THEORETICAL THROUGHPUT

Unlike in wired networks, the real throughput of the wireless networks is equal to half the theoretical throughput.

COMPARISON BETWEEN THE SYMBOL GENERATION RATE AND THE REAL THROUGHPUT AT ANTENNA OUTPUT								
Technology	Throughput (Mbits/sec)	Real nominal throughput (Mbits/sec)						
100 BASE T	100	> 90						
802.11b	11	5 to 6						
802.11 a & g	54	20 to 25						
802.11 n	300	90 to 150						

This means that the data feed provided to the access point must be the highest possible performance level in order not to minimize the upstream throughput. the cable lengths must also be shortened as much as possible, and male connectors (RJ45 plugs) with excellent performance levels must be used.

WIRELESS BUT WITH INTERFERENCE

Wi-Fi products, particularly those that support 802.11n, use Advanced RF signal processing technologies (such as MIMO, for example). These modulation methods generate electromagnetic waves covering a very wide range of high frequencies. For protection, particularly at the access point end, it is essential to use cables shielded by double aluminum foil such as F/FTP cables (outer aluminum foil and pair by pair). In contrast with tin-plated copper braiding, protection by aluminum foil is particularly effective at high frequencies.

POE PROTOCOL OR REMOTE POWER FEEDING

The majority of wireless access points are powered by PoE (Power over Ethernet) technology, which makes it possible to transmit data and provide power via the same RJ45 cable. The Wi-Fi access point is thus supplied with power without a conventional electric socket. This method of power supply generates an increase in cable temperature, by Joule effect, where the cable is not appropriately dimensioned. In order to provide optimum lifetime, an AWG23 conductor diameter must be used. The cable category is of little significance.



IN SUMMARY

Whether opting for conventional or IP telephone systems, for very high throughput networks or Wi-Fi with PoE and remote power feeding, it is important to choose the most suitable solution for each application.

	COPPER SYSTEM				FIBER SYSTEM				
Applications	Cat. 5e	Cat. 6	Cat. 6 10G	Cat. 6A	OM1	OM2	OM3	OS1	
10/100Mbits Network	•	•	•	•	•	•	•	•	
Gigabits network	•	٠	•	•	•	•	•	•	
10Gigabits network	0	0	•	•	\odot	\odot	•	•	
Analog telephony	•	٠	•	•					
IP telephony (VoIP)	•	٠	•	٠	•	•	•	•	
VoIP + PoE	\odot	٠	•	•					
PoE system	\odot	•	•	•					

• : Perfectly suitable • : Suitable Extract from the 'Key points in cabling' guide from Multimedia Connect

O : Not very suitable