

## **TE Connectivity Solutions Guide for Healthcare**

Delivering Bandwidth, Mobility and Security for Today's  
Healthcare Networks



# Table of contents

1. Scope
2. Introduction
3. IT challenges
  - 3.1- Bandwidth increase
  - 3.2- Mobility
  - 3.3- Data and IT Network protection
4. Networks infrastructure consideration
  - 4.1- Life time investment
  - 4.2- EMI/RFI environments
  - 4.3- Time of implementation
5. Responding to the environment
6. TE provides end-to-end infrastructure solution
  - 6.1- Data Center
  - 6.2- Across Healthcare Departments
    - 6.2.1- Fiber and Copper Cabling Infrastructure
    - 6.2.2- XG Cat.6A Copper Twisted Pair Cabling
    - 6.2.3- Harsh environment
  - 6.3- Managed Connectivity
  - 6.4- Video Distribution over Twisted Pair
  - 6.5- Passive Optical LAN
  - 6.6- Distributed Antenna Systems (DAS)
7. About TE connectivity
- Conclusion

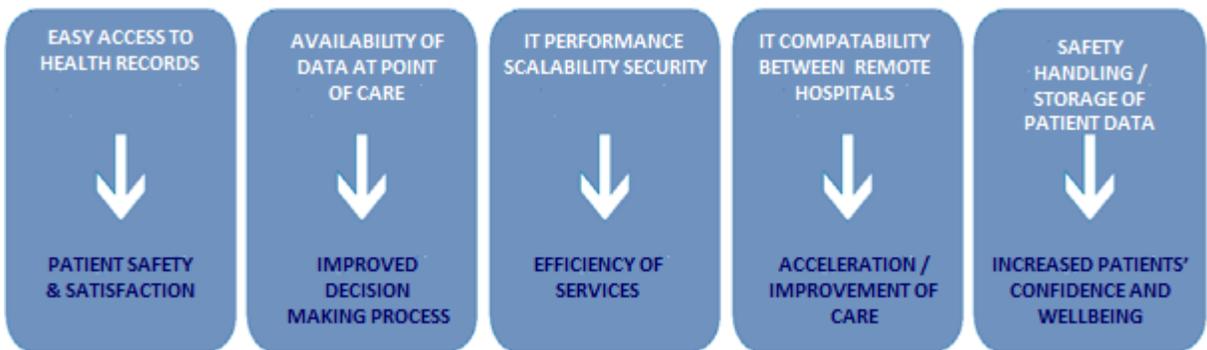


# 1. Scope

This document will provide guidance to the hospitals and clinics’ planning and deployment of IT network infrastructures. It explores the healthcare environment in which IT managers have defined business and technology objectives, the challenges they face and the expectations of the benefits of the solutions they are implementing. It provides recommendations based on TE’s decades of experience in this market and investigates specific areas of the healthcare IT infrastructure.

# 2. Introduction

Today’s healthcare facilities are undergoing significant changes in information technology as they strive to improve patient care, increase operational efficiency and support electronic health records, digital diagnostics and e-medicine initiatives.



Today’s healthcare systems have changed drastically in the last ten years. New technologies and equipment have brought changes to the healthcare facilities themselves. As a result, IT is more and more at the core of each individual application that runs across a healthcare facility.



With IP Convergence, which allows for the connection of different systems to the same network, IT managers are facing new challenges to provide the appropriate cabling infrastructure.

### 3. IT Challenges

Before any planning begins, it is important to understand what challenges are present that needs to be overcome. Years of experience in the healthcare market has provided TE Connectivity with valuable knowledge and understanding of the major challenges that Network Managers / Facility Manager often have to face.

- Provide enough bandwidth to support multi-applications
- Incorporate mobility for operational efficiency
- Secure data to protect patient information
- Reduce IT CapEx and OpEx

With many different systems and applications being deployed across the facilities, managing a network infrastructure can be challenging. In addition to a high degree of complexity, there is an overarching objective to reduce operational cost and boost efficiency.

#### 3.1- Bandwidth increase

From digital diagnostic imaging and telehealth technologies, to video conferencing and patient entertainment, healthcare facilities are increasingly becoming media-rich environment. Today's healthcare data centers and LANs need high bandwidth to effectively transmit vast amounts of information to and from storage area networks, multiple sites and outpatient facilities, administrative areas, and a variety of patient care and treatment environments.

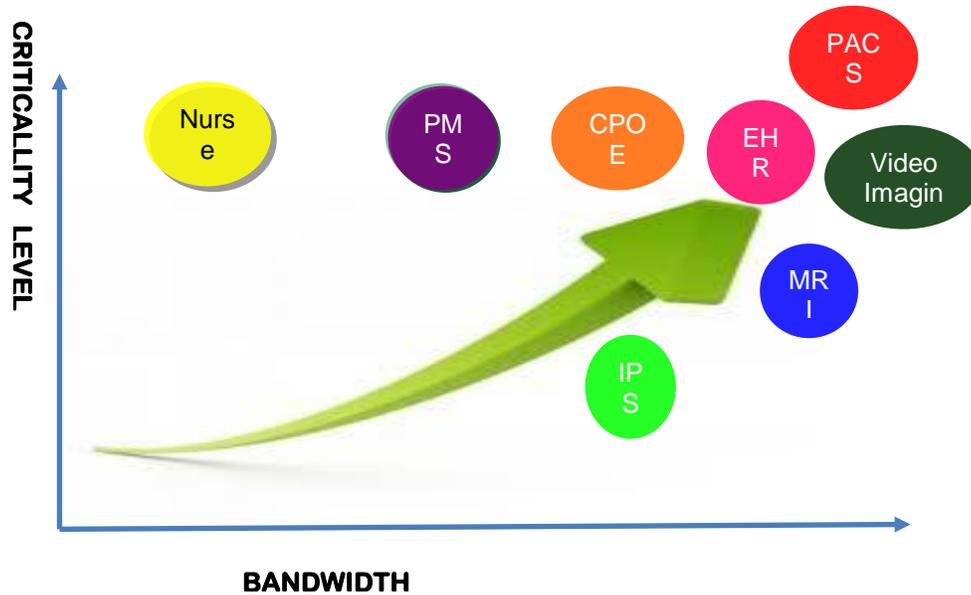
High bandwidth is a critical requirement in healthcare environments in order to support the different applications. Let's take as an example of a MRI which weights about 25 Giga Bytes. It would take 3 minutes and 20 seconds to transfer it through 1 Giga networks, 20 seconds through a 10 Giga networks and only 5 seconds through a 40 Giga networks.



In addition, high bandwidth is a need for regulatory compliance with internal healthcare procedures and standards. For instance, Picture Archiving Communication Systems (PACS) are the primary applications used to manage healthcare digital images. This is a complex combination of databases, applications, web servers and storage devices all working together. Limited bandwidth across LAN or WAN creates inefficient communication, in fact in many

instances image transport time across a WAN can largely exceed DICOM latency requirement parameters (Digital Imaging and Communication in Medicine), that being the fatal cause of errors or complete failure.

Despite the good working order of an IT system the image may not be delivered due to low bandwidth with high latency conditions.



### 3.2- Mobility

To maintain efficient operations, nurses, doctors and staff need to be mobile. Smartphones, tablets and other devices provide remote access to important health information, enable faster response and allow providers to better manage and coordinate care in complex healthcare environments. A variety of sensors and radio frequency identification tags also transmit vital signs and track medical assets via wireless technology.



### 3.3- Data and IT Network protection

Healthcare networks are becoming increasingly complex with more connections and systems than ever before. At the same time, electronic health information must adhere to proper use and protection per government e-Regulations. From segregating systems like patient

monitoring and nurse call, to preventing downtime and unauthorized access, managing and protecting networks is critical in the healthcare environment.

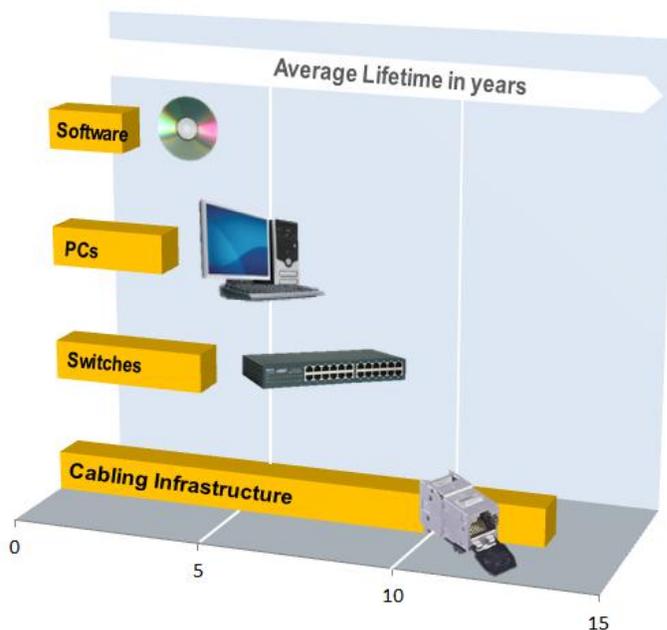


## 4. Network Infrastructure consideration

### 4.1- Life time investment

Hospital and clinic facilities are normally expected to last for decades while providing a high level of flexibility to support operating efficiency and productivity. With the multitude of network infrastructure design choices available today, IT managers are constantly faced with the challenge of how to optimize their data communication requirements. As well as traditional data transfer functions, new IP reliant applications such as VoIP, video streaming, medical devices, and surveillance systems for the office and data center, are continuously emerging. Consequently, faster and more reliable infrastructures are required to ensure that business critical applications are future proofed and return on investment optimized.

Because re-cabling the infrastructure would be costly and complex while the hospital or clinic operates, it is important to size the cabling infrastructure for today and the next 10 years activity.



### Lifetime of Network Equipment

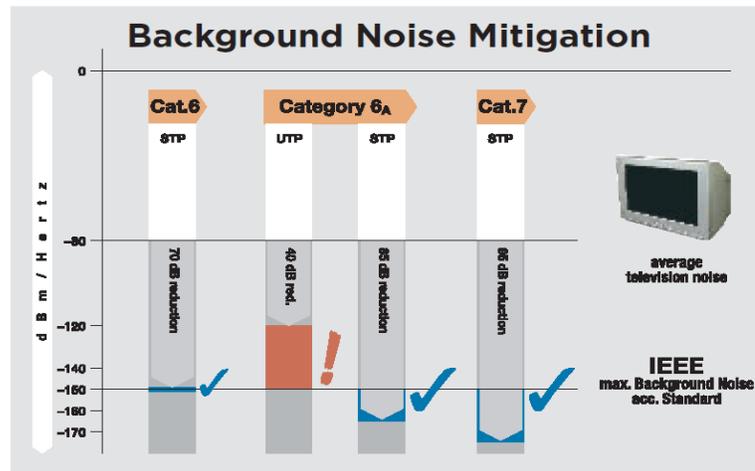
With the constant growth of processor power inside workstations, the demand for faster communication throughout the premises increases year by year. Considering that the physical layer of your network – the cabling itself – has an average lifetime of 12 to 15 years, it must be capable of serving about 3 generations of switching equipment, 4 generations of PC hardware and probably even 5 generations of software! Thus, planning for a fast and future proof communication network starts with the investment of a strong cabling system...

## 4.2- EMI/RFI interference environments

Some specific areas within hospitals or clinics may be susceptible to Electro-Magnetic-Interferences (EMI) or Radio-Frequency-Interferences (RFI). Magnetic Resonance Image (MRI) and X-Ray rooms and intensive care units are probably the most obvious instantiation of areas that are likely to be affected by the surrounded environment and therefore need special considerations.

Cabling standards throughout the world have adopted the MICE (Mechanical, Ingress, Climatic, and Electromagnetic) classifications for office and industrial environments. According to EN 50173-1:2007 an electromagnetic classification of "E3", which normally describes a heavy industrial environment, is applicable:

- If your premises are within a radius of 1 km from a TV, radio or mobile base station
- When you are using DECT phones within your premises
- When you are using wireless data (WiFi) equipment



Generally Background Noise is the sum of all the electromagnetic fields of adjacent devices. Immunity against Background Noise can be achieved by either shielded cabling or a fully enclosed pathway. Either requires proper earthing and bonding practices.

To ensure flawless 10Gb/s data transfer, the IEEE standard limits the Background Noise level at the device to a max of  $-150$  dBm/Hz, which in most buildings is compromised by wireless devices such as cellular phones, WiFi and aerial video transmissions.

The ability to mitigate these noise signals enables you to ensure flawless transmission of your High Definition Video Conferencing equipment, and removes any signal influenced disturbance

on your IP telephone system. As we become more reliant on the timely delivery of signals, it is recommended that you fully protect your systems.

### 4.3- Time of implementation

Upgrading existing healthcare facilities is not easy to plan in terms of installation. Finding “down time” when hospitals and clinics are open 24/7/365 is challenging. System Integrators have to reduce the time it takes to install cabling infrastructures.

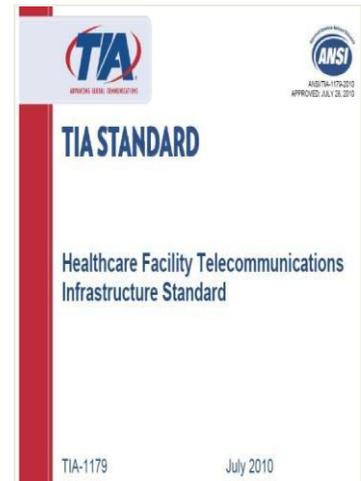
Fortunately, solutions exist to reduce these times. Pre-connectorized and plug & play solutions manufactured in factory reduce the initial requested time on field as installers do not need to connect connectivity on site.

### 4.3- Additional information

In 2010, TIA standards group issued the TIA-1179 Healthcare Facility Telecommunications Standards to guide for the planning and installation of a structured cabling system for healthcare environment. This document provides specific recommendations about the cabling pathways, spaces, media and outlets. The TIA-1179 document is available on <http://global.ihs.com>

Among these recommendations, we can highlight few of them:

- For new installations, TIA recommends a Category 6A cabling infrastructure
- TIA recognizes that some location may be sensitive to Electro Magnetic Interference (EMI), high temperature, chemicals, and other external conditions. To minimize any associated risks the standard suggests the use of solutions compatible with the surrounding environment.
- TIA recommends higher work area densities than standard commercial buildings based on the specific function of each area.
- TIA points out the necessity to segregate networks when necessary to ensure support of life and safety protocols



It is critical to note that a properly designed and installed cabling plant provides a solid foundation to deliver predictable and consistent performance, as well as providing the flexibility and security that healthcare environment requires.

## 5. Responding to the environment

From the data center to the patient bed, from the emergency room to the nurse's station, and from the gift shop to the security office, TE's physical infrastructure solutions are designed to serve any healthcare environment by supporting various critical applications while reducing complexity in design and implementation.



So, what media should be deployed to deliver the best level of services within a healthcare environment? In reality there is no right or wrong answer. Although there is tendency to believe that fiber optic would meet all the requirements, the reality is that a mixture of both copper and fiber has often proven to be the most effective approach to overcome all the challenges and maintain control of costs. However, because no two environments are ever the same, it is always advisable to carry out a site assessment before making any final decision on media deployments. This will guarantee the best possible fit of the network physical infrastructure in relation to the challenges posed by the surrounding environment.

Decades of experience in the healthcare market with hundreds of projects deployed around the world provides TE with a high level of knowledge and understanding of the environment.

Here are some recommendations for TE solutions that can better respond to hospital and clinic needs and address the challenges posed on their network infrastructure.

<p><b>Admission &amp; General Wards</b></p> <p><i>Un-Shielded Systems</i></p>  <p>=&lt;1Gb/s C6, C6<sub>A</sub> UTP =&lt;10Gb/s C6<sub>A</sub> UTP</p>	<p><b>EMI Sensitive Area</b></p> <p><i>Shielded or Fiber Systems For Complete Immunity</i></p>  <p>=&lt;1Gb/s C6 STP =&lt;10Gb/s C6<sub>A</sub> STP OS2, OM3 or OM4 Fiber</p>	<p><b>Secure High Bandwidth Data Path</b></p> <p><i>Fiber offers the highest bandwidth</i></p>  <p>OS2, OM3 or OM4 Fiber</p>	<p><b>Data Centre &amp; IP Convergence</b></p> <p><i>Shielded or fiber systems Offer highest reliability</i></p>  <p>=&lt;10 / 40 / 100 Gb/s C6<sub>A</sub> STP, OS2, OM3 or OM4 Fiber</p>
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In most cases copper shielded solutions help to ensure optimum protection against the adverse effects of external signal interferences. Simply by design, shielded systems provide total immunity against RFI/EMI and are capable to support highest bandwidth applications of 10GbE and above.

TE's many years of experience in shielded technologies deliver state-of-art systems to protect signal integrity and ensure maximum performance with minimum downtime.

## 6. TE provides end-to-end infrastructure solution

With every facet of administration, healthcare departments, searching, teaching and learning relying on the network, healthcare facilities need a partner with the proven experience, product portfolio and innovative expertise to deliver a high-bandwidth, mobile and manageable infrastructure that cost effectively supports the needs of today and tomorrow. That partner *is* TE Connectivity.



The main image shows a long, brightly lit aisle in a server room, with rows of black server racks on both sides. A person in a blue shirt is walking away from the camera down the center of the aisle. Below this are three smaller inset images: the first shows a person in a white shirt working with yellow fiber optic cables; the second shows a close-up of blue fiber optic cables plugged into a patch panel; the third shows a close-up of blue fiber optic cables with green indicator lights.

### CABLING SYSTEMS

Fiber or copper, shielded or unshielded. TE's range of cabling and connector products form the infrastructure of some of the world's largest 'mega data centers.'

### PLATFORMS

TE's integrated cabling platforms for high fiber count and mixed media environments include platforms that are custom designed to work with specific configurations to deliver efficient and agile data center operation.

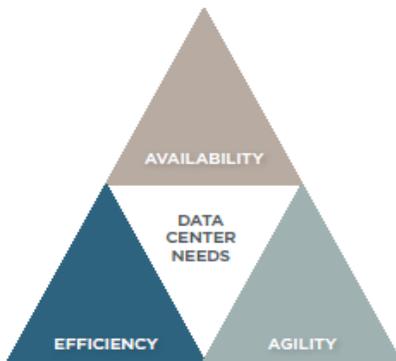
### MANAGED CONNECTIVITY

TE Connectivity has sold more intelligent ports worldwide than any other manufacturer and has now introduced Quareo, the world's first managed connectivity solution based upon connection point identification technology.

## 6.1- Data Center

Known as the heart of the IT network, Hospital and clinic operations rely on their information systems and storage to run operation such as Electronic Medical Records (EMR), Electronic Health Records (HER), Picture Archiving & Communication System (PACS), security and many others. Health continuity is essential in a just-in-time environment where any downtime could create a chaos.

TE jointly develops solutions with many of the world's leading data center equipment manufacturers. This combined with global reach and innovative managed connectivity technology, puts us in a unique position to help our customers deliver on their business requirements by creating a resilient, efficient and agile data center infrastructure.



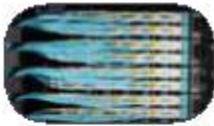
**AGILITY:** Networks constantly change and grow. Our storage Area Management Solution (SAM) and Q3000 high-Density fiber solutions can help ensure successful network upgrades and implementations with maximum ease and control.

**AVAILABILITY:** TE's Managed Connectivity Solutions, including our Quareo connection point identification technology can help increase uptime, resilience and service continuity by delivering an automated, real-time understanding of end-to-end network connectivity.

**EFFICIENCY:** Our energy saving MRJ21 cabling system, along with industry-leading high density cable management solutions like our FiberGuide™ optical raceway can help ensure stringent CapEx and OpEx control.



## FIBER



Fiber Panels



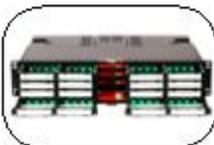
Fiber Cable



FiberGulde  
Optical Raceway



Storage Area  
Management



Managed  
Fiber Chassis



MPO Cassette

## COPPER



MRJ21 Pre-  
Terminated Copper  
Cable Assembly



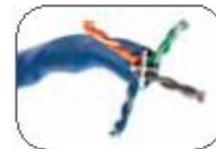
Highband Block



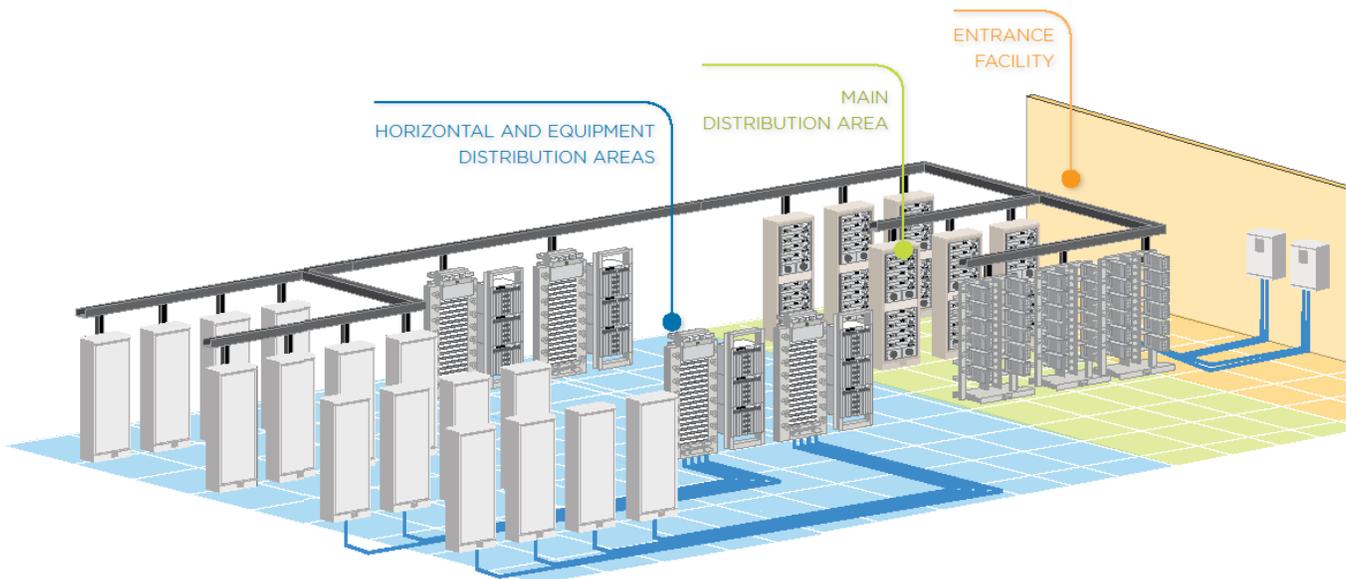
MRJ21 Patch Panel  
Front (left) Back (right)



Cat 6A F/UTP Cable



Cat 6A U/UTP Cable



## MANAGED CONNECTIVITY



Quareo



Infrastructure  
Configuration  
Manager Software

## 6.2- Across Healthcare Departments

Healthcare data needs to quickly, reliably and securely reach its destination. Whether it is patient monitoring information at the nurse stations, digital MRI images from an outpatient center, cable television signals in the patient room, or surveillance videos from security cameras, the healthcare LAN requires bandwidth and performance to reliably deliver a variety of information from the data center to end devices.

To maintain efficient operations, nurses, doctors and staff need to be mobile. Smartphones, tablets and other devices provide remote access to important health information, enable faster response and allow providers to better manage and coordinate care in complex healthcare environments. A variety of sensors and radio frequency identification tags also transmit vital signs and track medical assets via wireless technology.

Only TE can provide the cabling and connectivity solutions as well as the tools to manage your network. Thousands of customers around the globe trust TE technology as the foundation of their LAN infrastructure.

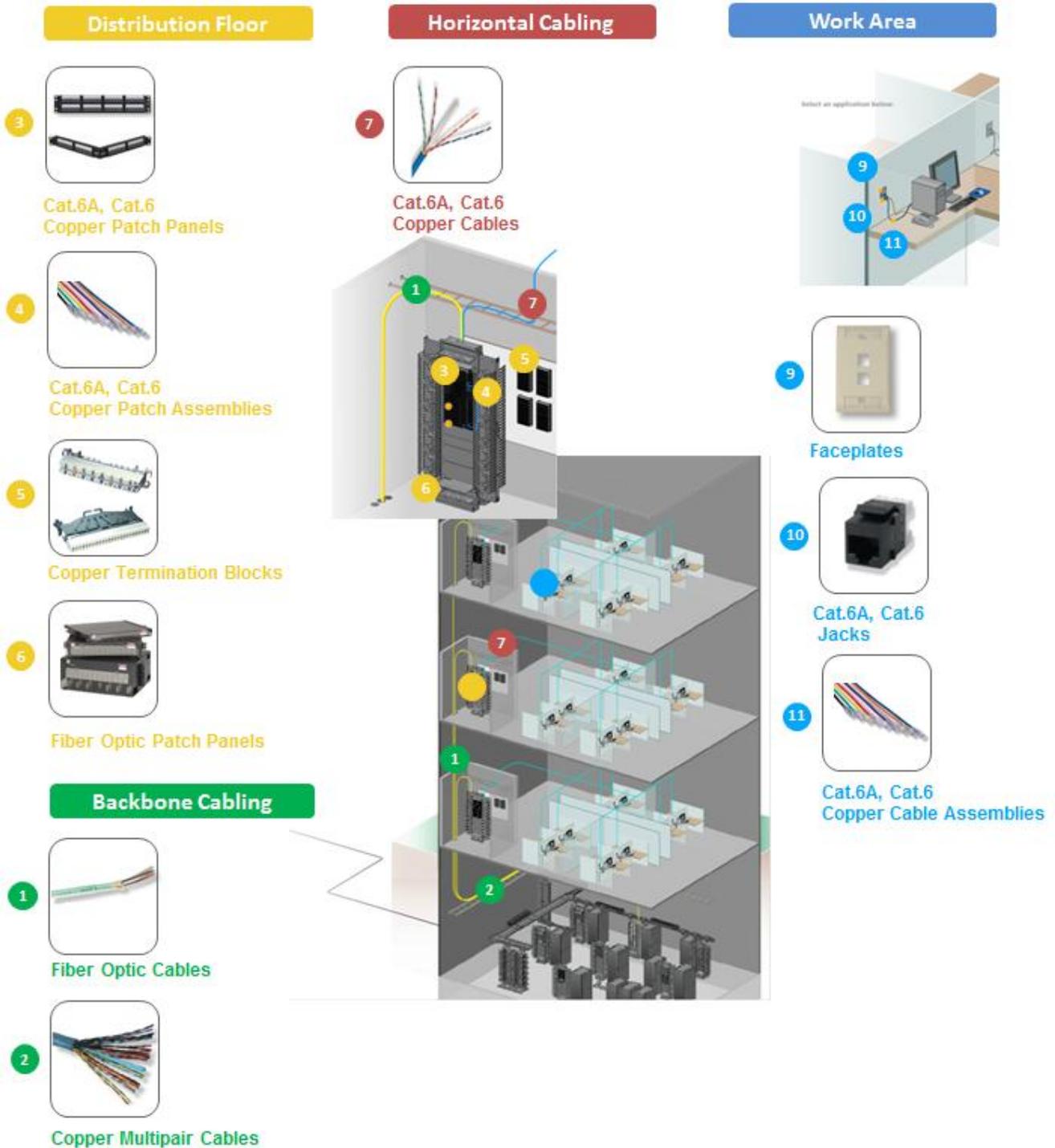
Our LAN solutions include:

- Copper shielded and unshielded cable and connectivity to support the latest IP-based applications, from 1 to 10 gigabit Ethernet, to PoE, VoIP and security systems.
- Cabling Infrastructure Management system (Quareo) to bridge the gap between network management and the physical layer.
- Video distribution system (VDS) to cost-effectively deliver high-definition RF over twisted-pair cabling for distance learning, surveillance, digital signage and cable television.
- Optical LAN solutions (OLS) for indoor/outdoor, long-distance passive optical links that use a single strand of high-bandwidth singlemode fiber with lower power and space usage and reduced operation costs.
- Distributed Antenna Systems (DAS) create a leading platform for serving wireless services.



## 6.2.1- Fiber and Copper Cabling Infrastructure

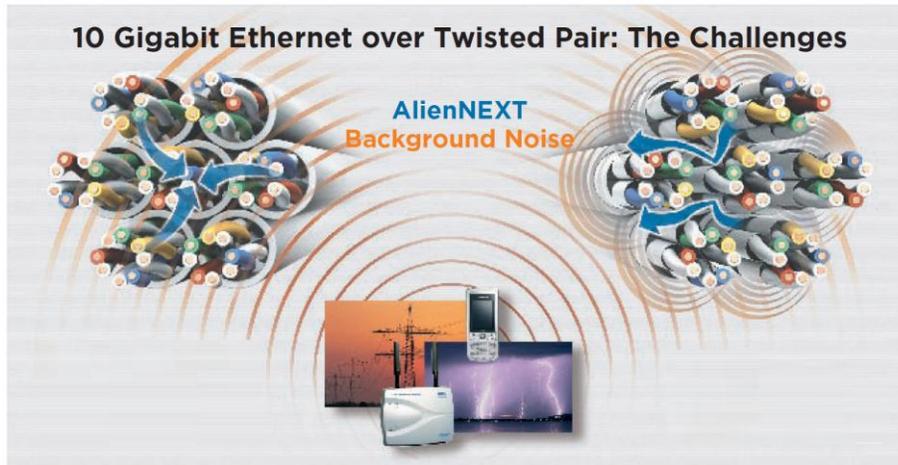
With one of the industry's broadest ranges of fiber and copper UTP and shielded products supporting applications from 1G to 10G, TE delivers the best choice of products to suit your specific network needs to the users.



## 6.2.2- XG Cat.6A Copper Twisted Pair Cabling

While fiber effectively supports speeds beyond 10 and even 40 Giga, the industry is still embracing cost-effective copper. Whereas the shielded solution offers superior noise immunity to eliminate alien crosstalk and RFI/EMI, UTP solution utilizes superior technology to reduce alien crosstalk noise to enhance overall performance.

Both solutions meet all requirements for Category 6A AINSI/TIA and ISO Standards.

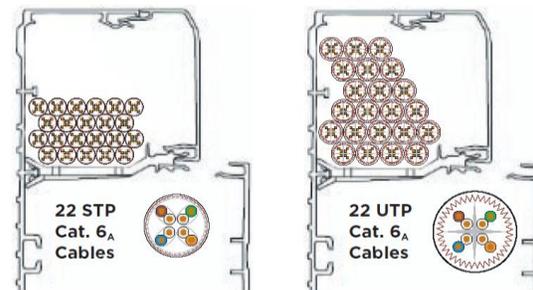


### XG Cat.6A Copper Shielded Twisted-Pair

- Superior noise immunity to eliminate Alien Crosstalk and RFI/EMI
- More headroom
- Performance over 500 MHz for advanced and future applications
- Better heat dissipation to handle Power over Ethernet



The XGA Shielded Copper system for 10GBASE-T also has the benefit of requiring space in cabling pathways and cabinets, while providing better background noise mitigation, making it an excellent choice for high speed application support.



less

A UTP Cat. 6A 10 Gb/s system requires 60% more space in cabling systems than a comparable STP system.



Shielded cabling is widely installed throughout the world and always outperformed unshielded in a variety of applications.

### XG Cat.6A Copper Unshielded Twisted Pair

Shielded Cat.6A solutions offer a high performance level, however Cat.6A Unshielded can be an alternative solution in a non-sensitive background noise environment. Thanks to AirES technology used in our XG Cat.6 UTP cables which reduce their diameter and the superior technology used in the connectivity to reduce alien crosstalk noise, the TE's XG Cat.6A unshielded solution is among the most performing unshielded solution in the market.



### 6.2.3- Harsh Environment

Some areas inside hospitals, clinics or labs must be sanitized and cleaned thoroughly to avoid contamination. This practice could affect the outlets if they were not sealed. TE provides IP67 solutions. It means outlets which are protected from immersion in water for 30 minutes at a depth of 1 meter.



### 6.3- Managed Connectivity

In hospitals or clinics, each transaction, communication and facility operation is being accomplished with numerous end devices and applications that reside on the local area network (LAN). Accordingly, IT departments need to maintain and manage more connections than ever before throughout the physical layer infrastructure of the network. In the data center, the growing number of applications, virtual servers, storage devices and high-density switches, also is requiring more connections in physical layer, cross-connects between servers and switches. All these connections – from data user points to the data center – yield a much more complex physical layer.

The challenges and costs associated with network physical layer management and maintenance are staggering—the time consuming process of tracking, analyzing and resolving network disruptions has a direct impact on an organization’s bottom line. As the physical layer becomes even more complex, these costs increase. While tools and software have long enabled network and data center managers to manage switch and server ports, the passive connections in the physical layer between the equipment and end devices have been excluded from these systems. With the physical layer being the foundation of the entire network that all business activities depend on, network and data center managers are now looking for ways to effectively manage this vital infrastructure in a way that improves productivity and response time while reducing downtime and operating expense.



Managed Connectivity solutions from TE are helping network and data center managers bridge the gap between network management and physical layer management, transforming the physical layer into a strategic asset and revolutionizing the way networks are managed and controlled. By providing a real-time comprehensive picture of every connection point in the physical layer, managed connectivity significantly improves productivity and efficiency of physical layer management and maintenance processes while reducing costly downtime and operating costs.

With TE's managed connectivity solutions, network and data center managers can:

- Provide faster, more accurate service and repair
- Map and monitor physical layer connectivity changes
- Document and report network reconfigurations
- Identify and alarm unauthorized network access
- Track a variety of network assets in real-time
- Improve switch port and asset utilization

### **Why Manage the Physical Layer?**

Businesses and organizations worldwide are more dependent on their physical layer than ever before. From computers, phones and wireless devices, to alarm systems, security cameras and video conferencing, today's network physical layer touches virtually every device throughout an organization. Security of the physical layer also has become a top concern among network and data center managers, especially in healthcare, financial and mission-critical organizations where data is required to be secure.

With 60 to 80% of unplanned downtime originating in the physical layer, the costs and time involved with managing today's complex infrastructures using traditional methods has taken its toll on IT departments. Human error, security breaches and time consuming maintenance are eating up IT budgets, causing costly network downtime and increasing overall operating costs. Network downtime for any organization is an extremely costly situation—conservatively estimated at \$42,000 per hour for the average organization, and up to \$1 million or more per hour for an e-commerce or online brokerage firm (The Gartner Group). Furthermore, while data centers continue to house more equipment and connections, they are not necessarily adding more staff to manage these spaces. A study by AFCOM, a data center managers group, reports that while nearly 75% of data centers have increased their server count, 66% reduced or maintained their data center staff. That means that most of today's data centers are managing more systems with same number of people or fewer.

Managing the physical layer and its every connection point via managed connectivity can help network and data center managers confront the following issues:

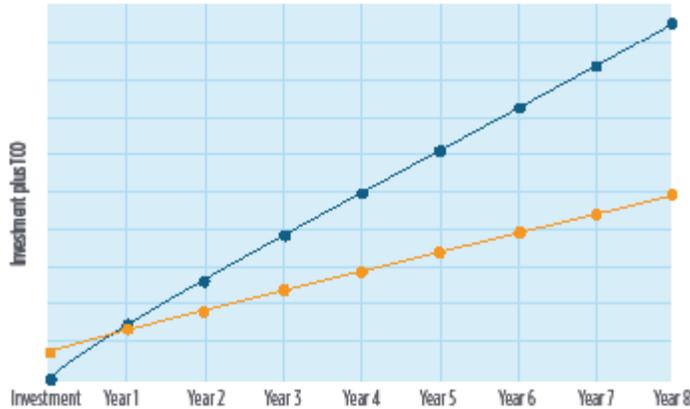
- **Security** Every organization must mitigate the risk of network intrusion to prevent compromise of critical business information.
- **High Availability** Today's networks require uptime for business continuity, but network and data center managers currently lack visibility of the physical layer.
- **Operating Expense** The high cost associated with physical layer maintenance has a direct impact on operating expenses. Accurate knowledge of physical layer topology leads to less network issues and faster resolution of problems.
- **Compliance** There are a variety of government regulations, compliance and reporting requirements regarding how an organization's data is accessed, transacted and stored. Existing network management tools do not enable intrusion detection and logging of

events as related to physical layer connections—only Managed Connectivity solutions have that ability.

- **Capacity and Scale** The ever-increasing amount of data and number of devices on the network continues to drive complexity in the physical layer. It is more critical than ever to deploy solutions that allow for flexibility and efficient use of assets.

By managing all connections and changes in the network, network and data center managers can easily see the topology mapping and status of a connection. The time required for a

Figure 1



standard network MAC or diagnosis can be cut in half, improving meantime to response, ensuring quality of service and reducing operating expense. As shown in Figure 1, TE's managed connectivity pays for itself within the first two years.

## Managed Connectivity Solution

Part of the portfolio of TE's Managed Connectivity Solution, Quareo, is the only solution available that uses connection point identification technology to track specific information about each connector and cable in the physical layer.



Quareo utilizes microchips that are embedded in the connectors of TE's high-performance copper and fiber network cabling solutions. These microchips have information related to the cable itself, as well as unique identifiers for each connection point in the network. Quareo can identify everything from port location and circuit length, to polarity, cable type, color and manufacturing information. It also is the only solution with the capability of monitoring both the front and rear of a patch panel. This enables monitoring cable connections that come into the back of the patch panel, as

well as connections within the cross-connect and to the switch and servers, offering customers the ability to trace end-to-end connections from the computer to the switch. Using a standard form factor and footprint, Quareo solutions are easily deployed in existing fiber and copper networks. With a comprehensive product portfolio, Quareo can accommodate both fiber and copper applications from the simplest LAN environment, all the way to the most highly dense, complex data center environment

## Infrastructure Configuration Manager (ICM) Software

Infrastructure Configuration Manager (ICM) is a software application designed to document and administer both passive and active network connectivity infrastructure, and is specifically designed for customers of TE's Managed Connectivity Solutions. ICM powers TE's advanced



Quareo connection point identification technology, providing customers with a single platform for both solutions.

ICM creates an automated, accurate, real-time physical layer management system that is designed to explore, discover and map all the connections of the network, allowing data center and network managers to simplify the process of all moves, adds and changes, improve security

and reduce operating expense.

TE's Managed Connectivity Solutions, enabled by ICM, help customers eliminate time-consuming manual work order processes, easily identify and locate specific ports, auto-discover IP assets, and trace data center circuits from the switch through the cross-connect to the server.

The systems also help maximize network investment by identifying under-utilized assets and improving security through real-time monitoring and programmable alerts.

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## 6.4- Video Distribution over Twisted Pair

TE's Video Distribution System (VDS) enables network managers to deliver true high-definition RF and IP video over a Category 6, 6A, or 7 twisted pair cabling infrastructure without the need for coaxial horizontal cabling or any RF tuning.

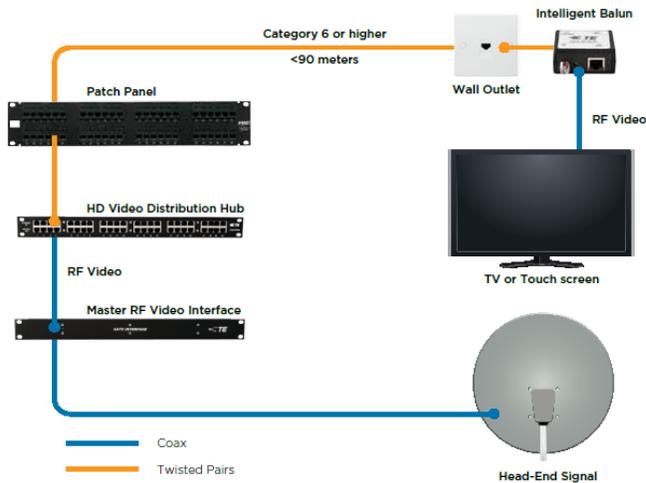
VDS enables the delivery of video signals such as cable television, satellite, in-house video, digital signage, electronic bulletin boards or any other service normally delivered over coaxial system – but over a twisted pair infrastructure.

This solution is the answer to hospitals and clinics needs in terms of video distribution. It covers video requirement of any place inside hospitals or clinics such as patient room and lobby.

VDS is a TIA-568/ISO 11801 compliant solution that provides these key benefits:

- \* Provides full RF video spectrum, along with IP video, over a single Cat 6/7 cable
- \* Auto adjusting RF signal eliminates the need for manual tuning
- \* Plug-and-play components provide ease of installation and system design/maintenance
- \* Head-end output is automatically adjusted for proper system operation
- \* Powered over cable – the remote active balun is powered over the twisted pair system

\*Bi-directional signaling compatible with interactive control requirements

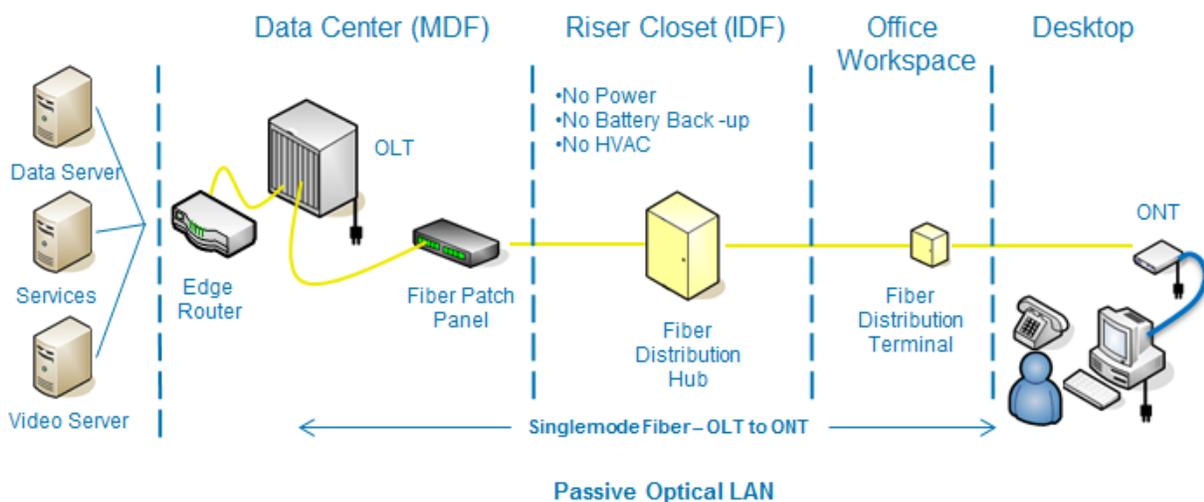


## 6.5- Passive Optical LAN

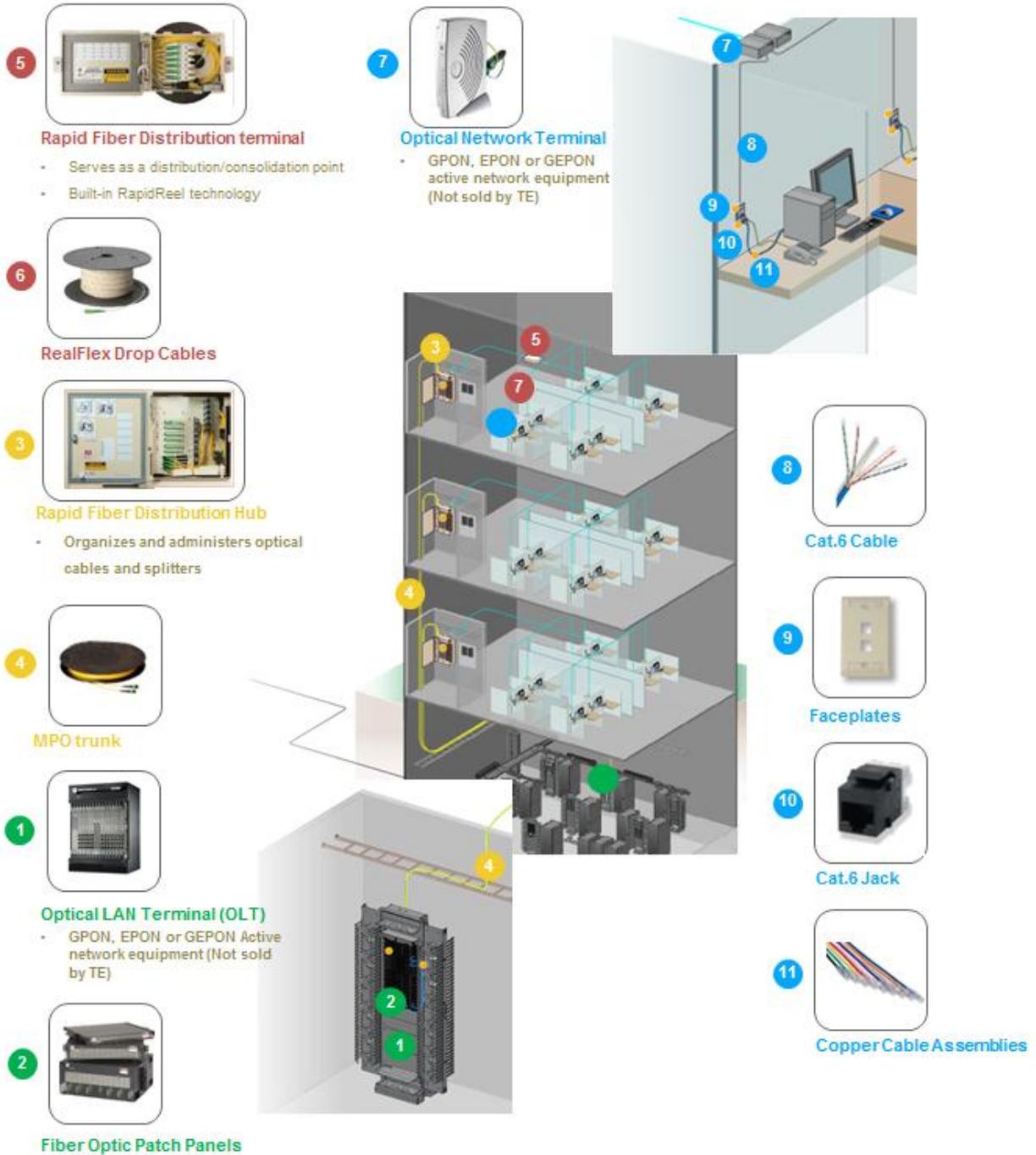
Because hospitals may have long distance from one point to another with a high degree of background noise, fiber optic solutions can help overcome these challenges. Of course, we can use fiber optic to build hospital/clinics' network backbone and inter-buildings links. But today, with Passive Optical LAN solution, we can build an end-to-end fiber optic infrastructure, from the data center (Equipment room) to users (Desktop or any IP devices) in a very cost effective manner.

A Passive Optical LAN is a point-to-multipoint architecture that employs unpowered optical splitters that enable a single strand of singlemode optical fiber to serve multiple users. At each end, you have an Optical Line Terminal (OLT) based in the data center or equipment room and an Optical Network Terminal (ONT) at the user locations. Downstream signals are directed to multiple users using the splitter technology. Upstream signals are combined using multiple access protocol by using the splitter in the opposite direction. A PON takes advantage of wavelength division multiplexing (WDM), using one wavelength for downstream traffic and another for upstream.

In a POL, the OLT provides the interface between the building core router and the passive infrastructure POL. The ONT is a device that terminates the POL and converts the signal to one or more twisted-pair outputs to interface with the Internet protocol (IP) enabled network devices, including IP phones, computers, card readers, cameras, Wireless access points (WAP's) using a standard RJ45 connection. A POL is a shared network – the OLT sends a single stream of downstream traffic that is seen by all ONT's. Each ONT only reads the content of those packets that are addressed to it. Encryption is used to prevent eavesdropping on downstream traffic.



TE's Optical LAN Solution (OLS) is an enterprise POL architecture that leverages the distance and bandwidth capabilities of single mode fiber to deliver converged voice, video, data, and building automation over a single strand of fiber. OLS enables efficient management and utilization of bandwidth and offers measurable OpEx and CapEx savings and 'green' benefits.



## 6.6- Distributed Antenna Systems (DAS)

With the increasing popularity of wireless devices, mobile operators' customers expect to have a coverage anytime and anywhere in the hospitals or clinics. This capability requires to increase indoor network capacity within hospitals or clinics.



TE's advanced wireless solutions create a leading platform for serving wireless services providers inside schools or universities. Our unified architecture for every application in the micro cellular space delivers coverage and capacity to match your needs. The InterReach\* solution operates as a seamless extension of the wireless network, expanding the reach of signals throughout any healthcare infrastructure size.



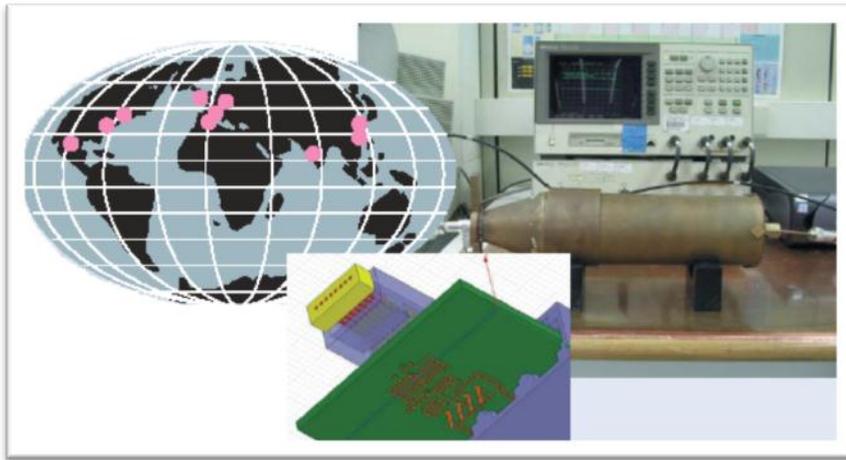
InterReach Spectrum solution



## 7. About TE connectivity

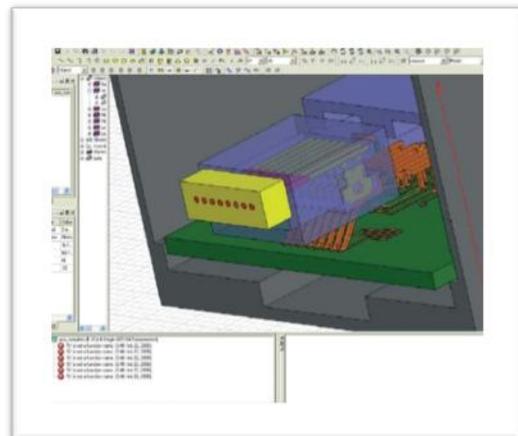
### The Global Network of TE Connectivity Labs

TE, a leading global technology provider of network solutions, has designed and engineered many options to support future data speeds in Local Area Networks. We have developed a technology matrix that provides IT administrators with a clear overview of available technology. Extensive laboratory research needed to support existing and emerging applications, combined with many years of experience in development for global telecommunication providers results in superior solutions for 10 Gigabit Ethernet over copper and fiber.



### Design and High-Tech development

TE uses extremely new development tools to design and engineer functional and reliable products. By using software simulation programming and extensive modeling, we are able to ensure the best possible product performance.



## TE's Standards Leadership

Today's standards activities drive tomorrow's new products and applications. TE participates in more than 600 different global and regional standards bodies. In fact, TE contributed and participated in all the standards committees involved in creating the application, component and systems standards for 10GBASE-T. TE is leading efforts in IEEE, ISO/IEC, CENELEC and TIA that will define tomorrow's high speed transport technologies and we contribute actively to these with our innovation and research and by our standards leadership.

With three regional Enterprise Networks business unit research and development facilities around the globe, TE leads innovation in cabling infrastructure, enabling our customers to enjoy higher speeds developed according to their market.

- US\$688 Million of annual RD&E investment worldwide in 2012
- New products accounted for 24% of sales over the last 3 years
- Around 7,400 engineers globally
- Over 20,000 patents issued or pending

## TEOA – TE's Operating Advantage

TEOA, a six sigma-like standard established internally by TE for enhancing productivity, product engineering and quality, has helped to ensure TE products are nearly flawless. Setting the bar high and ensuring customer satisfaction with premium products that meet or exceed industry standards is our goal.



Backed by a 25-year performance warranty, TE's XG cabling solutions are fully compliant to Category 6A performance specifications as defined by ANSI/TIA 568-C.2. Our XG shielded systems also meet both IEEE 802.3an 10GBASE-T and ISO/IEC 11801 Class EA requirements for 4-connector 100-meter channels.

## Managing Environmental Impacts

Our efforts to reduce our environmental impact reflect our core values of taking responsibility and doing the right thing and underscore our commitment to being a good corporate citizen in the communities where we do business.

In all of the countries where we operate, we hold ourselves to a high standard — often above local requirements and practice — and we are committed to continuous improvement.

To meet our goal of reducing our environmental impacts by 10% by 2012 we will:



- Measure and report our progress as part of our regular monthly review of operational performance
- Use operational improvement tools and programs to reduce the amount of resources we use and the amount of waste we generate
- Engage employees in our efforts
- Identify and apply best practices for reducing environmental impacts in common processes at TE

More than 60 of TE's sites have their environmental management systems (EMS) certified to ISO 14001 by third parties. To achieve certification, a facility must demonstrate that it has an EMS in place that identifies significant environmental impacts, sets goals and targets, and has a robust system for evaluating performance, taking corrective actions where needed, checking status on an ongoing basis, and continually improving performance.

To learn more about TE Connectivity engagement and actions, please visit:

<http://www.te.com/en/about-te/responsibility/environment.html>



### **Our Global Partner Network is Your Local Advantage**



**TE Connectivity has a network of over 1,700 authorized TE Network Design and Installation (ND&I) partners in 59 countries**

With over 90,000 employees, including 7,400 engineers, in over 50 countries, we can support your company wherever it chooses to go. With knowledge and experience comes understanding. We understand the issues with data center and office networks and what customers are facing. It is why we developed the solutions you need for your technology investment.

TE has global supply chain capabilities and logistics support, with an extensive network of industry-leading distributors to stock Enterprise products locally in locations around the globe. In addition, over 150 TE Connectivity owned warehouses provide additional stocking flexibility.

## Conclusion

Hospitals and clinics are challenging and complex environments. The IT network infrastructure plays the role of strategic asset to enable the correct level of support of the various business operations. Good planning of network strategies can deliver great benefits in reducing the level of complexity while boosting efficiency.

Moving from data center to administrative area, from examination to patient room, IT managers need to think of the best possible way to maintain high level of service.

With more than 60 years of experience engineering better cabling, components or connections, we can help you build, maintain or expand the network infrastructure of your airport.

From data centers and office networks, to managed connectivity for better network control and wireless solutions, TE is a global leader in the design and manufacturing of high-performance, reliable, scalable end-to-end cabling and connectivity solutions. Standards-based, and interoperable, our product portfolio is the most extensive in the industry.

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Version 1 – April 2013

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