

LINK

Connectivity Solutions

Global Customer Newsletter

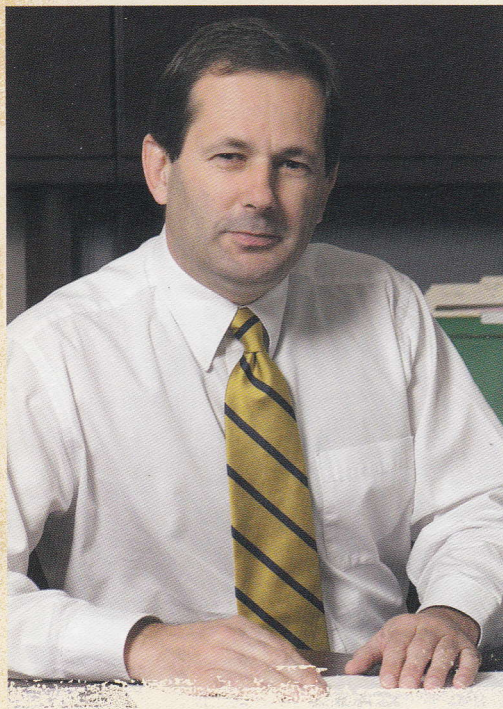
Spring 2001

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Taking Technology for Granted

The mark of a successful system is that users don't talk about it. They simply assume the communication and computer power they need, will always be available. Yet, as everyone in the IT business knows, technology that consistently satisfies an organization's needs does not just happen - it takes a great deal of expertize and effort.



David Phillips

Vice President, Worldwide Sales Connectivity Solutions

for instance, the University of Texas has systems for multi-dimensional graphical presentations linked via GigaSPEED®, OptiSPEED™ and LazrSPEED™ Solutions at up to 10 Gb/s. With capacity like this, bandwidth constraints are not an issue for staff and students.

In the commercial sector, at DHL, the GigaSPEED Solution is providing the fast information delivery critical to the business. At DHL for example, waiting time on every transmission is minimized and there is plenty of capacity for future time saving measures, such as sending actual images of documentation. In the UK, Sun Microsystems™ relies on Avaya for similar reasons. At its new office "super campus", Sun's own advanced systems depend on GigaSPEED and LazrSPEED Solutions, which also link Avaya Definity®, Audix® and CenterVu® Solutions.

This is especially true when networks are upgraded. Our cover story addresses just how much care is needed in making the right decisions from the start. Taking James Donovan's advice on this will help to specify a system that never attracts attention by failing its users. But to get a system from the specification stage into the workplace also requires the right products and skills. This edition of LINK also reveals some of the behind-the-scene expertize and effort that ensures Avaya can offer customers the right solution to meet any network challenge.

The story can be traced back to the research stage. At Avaya Labs, well known industry figures are working to extend the limits of communication over copper cable. These are the same people who helped transform simple twisted pair cables into a means of supporting Gigabit networking. Today they are still developing innovative technology that will keep Avaya's customers ahead in the new customer economy.

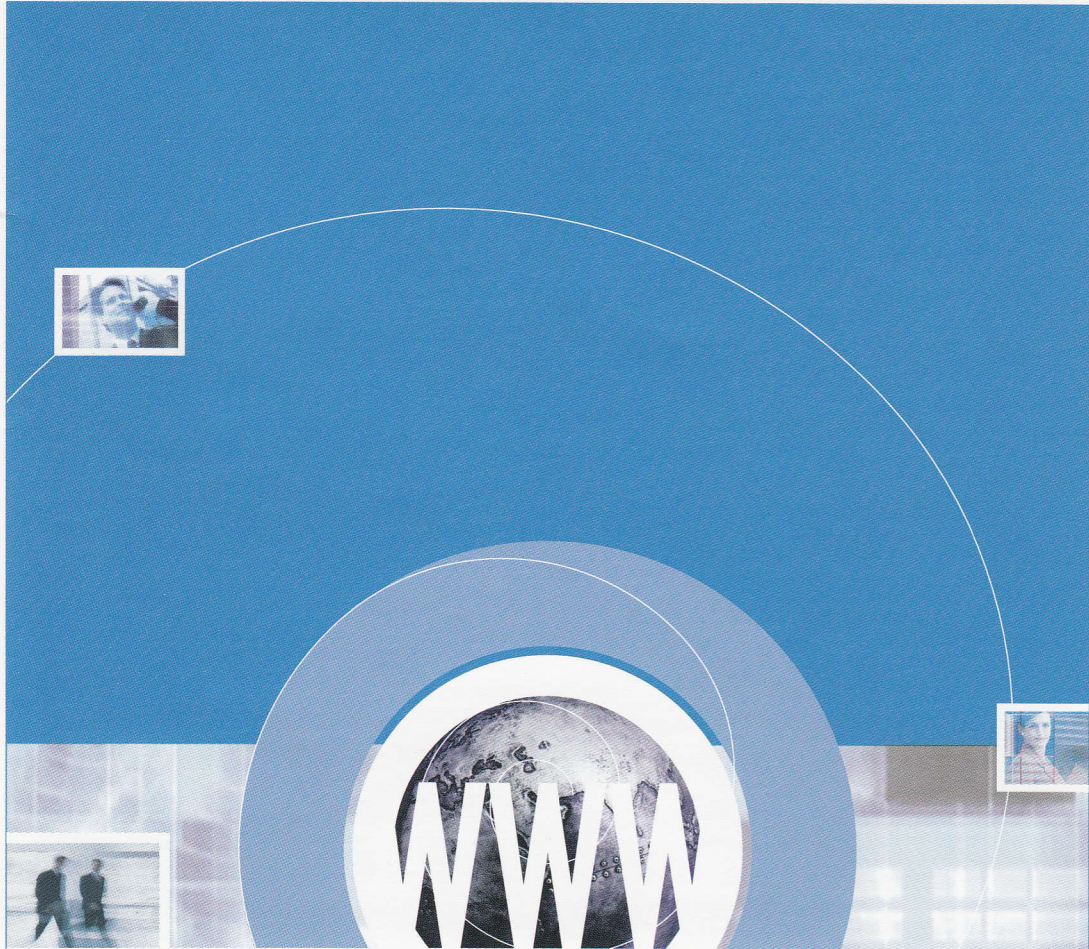
From the laboratory, new communication technology progresses to national and international standards bodies. Before innovations are fully accepted, they must be standardized by organizations such as the IEEE and ISO. Avaya technical staff play key roles. Later in this issue, Hans-Ulrich Roos, Manager of International Standards at Avaya Labs, explains the importance of standards, and how he and his colleagues assist in developing them.

In addition to standards, Avaya Labs also focuses on top level support to resolve issues with both current and future networks, assisted by a comprehensive application test program, that is addressed in the article entitled "Assuring your Peace of Mind".

Benefits from all this activity are, ultimately, seen in the ability of customers' systems to deliver results in a vast range of applications. In the academic world,

The other vital part of the structure that enables customers to benefit from Avaya's depth of resources are its BusinessPartners around the world. As suppliers, designers, installers and maintainers of Avaya solutions, these companies are committed to providing the highest quality of service. Together with support from Avaya, they help ensure network users can focus on what they want to communicate - and forget the technology that makes communication possible.

I hope you enjoy reading this issue of LINK. An electronic copy is also available on our website at <http://connectivity.avaya.com>. We welcome your comments, requests for topics you would like to see covered in future issues or for information on any of the subjects or solutions presented in LINK. Please send them to us at link@avaya.com.



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The Cost of Converting to High-speed Networking

By James Donovan, Strategy Director,
Connectivity Solutions, Avaya

High-speed networking is not cheap, it's not easy, and consequently it should not be entered into lightly without careful planning and allocation of resources. Therefore, before you launch into an implementation project, it is recommended that you:

- Determine exactly which segments will benefit from a high-speed protocol.
- Carefully estimate the costs of converting to a high-speed protocol.

To help you "put a pencil" to these potential expenses, the major cost components of a high-speed network are outlined in the following article.

To speed or not to speed

Before you can estimate costs, you'll need to determine which segments of your network you want to upgrade. This can be your most difficult planning task, because you'll want to implement high-speed networking widely enough to provide you with adequate bandwidth for the foreseeable future, but not implement any more than you'll really need during that time because of the high costs associated with it. Here are a few guidelines to help you develop a good scope for your network conversion project.

- **Upgrade your network to see you through the next 18-24 months.** Upgrades intended to last less than that amount of time will be outdated almost before

they are complete. The future beyond 24 months is too unpredictable. Under no circumstances should you claim that no further upgrades will be required for more than two years. The networking industry is changing too fast to make such dangerous assertions.

- **Whenever possible, upgrade your cabling infrastructure universally.** For example, if you're going to have to upgrade high-speed segments from Category 3 or 5 to Category 6 cable, go ahead and upgrade your whole network to Category 6. The incremental cost of upgrading cable is fairly low, and having a versatile cabling infrastructure will save you time and money in the future.
- **Upgrade the busiest 20 percent of your network.** The 80-20 rule usually applies in networking as well as other business areas, so upgrading the top 20 percent of bandwidth starved segments should cover most of your problem areas.

Hardware requirements

The cost of equipment is probably the first and most obvious expense related to installing a high-speed network. What may not be so obvious, however, are the many costs directly and indirectly related to installing new hardware. The following outlines the equipment and related costs you will have to consider.

Servers

When upgrading servers, be sure to contact your NOS (Network Operating System) vendor to find out exactly which network adapters and drivers are fully certified for the version of the NOS you

now have. Remember, high-speed networking is relatively new, so the version of the NOS you currently have installed may not support high-speed protocols. If it doesn't, a NOS upgrade will be in order. Furthermore, a new version of the operating system - or even a high-speed NIC driver - may require other hardware upgrades, such as increased memory or disk space. Be sure to ask your vendors about system hardware requirements, and figure any upgrades into your cost estimate.

Hubs

The number of hubs you require depends on two things:

- How many ports you will be converting to a high-speed protocol.
- The port density of the hubs you want to purchase.

If you are purchasing stackable hubs, the smallest unit you can buy is a hub. Note that some stackable hubs require separate terminators/interface cards, so be sure to include the cost of these terminators in your estimate.

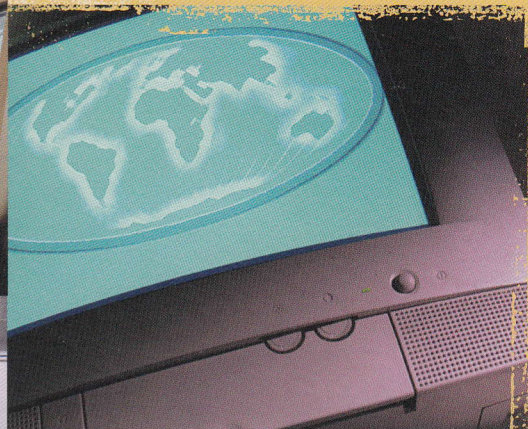
If you have purchased or are planning to purchase a chassis-based unit, the smallest unit will be a chassis module. In either case, be sure to include the cost of special cables and connectors required to attach the high-speed ports to your existing network.

Finally, remember to include the cost of any changes that you'll need to make in your wiring closet to accommodate the



High-speed Networking

Careful planning is essential to gain maximum benefit



new hubs, such as additional racks and patch panels.

Routers

Your routers may require new physical interfaces, either internal or external, as well as software and firmware upgrades to work with a high-speed protocol. They may even have to be replaced altogether. In either case, some manual configuration will be necessary, so be sure to indicate all the associated costs.

Switches

You may need to purchase or upgrade existing switches. Upgrading your switches may involve high-speed interfaces or firmware upgrades. Be sure to quiz your vendor to make sure you know everything involved in preparing your switches for high-speed networking.

Workstations

Implementing high-speed networking at the workstation involves many of the same considerations as upgrading servers. Contact your workstation vendor to make sure the network adapters you have

chosen are compatible. Select network adapters with PCI or EISA buses if at all possible. Also, make sure the workstations are running a version of the operating system that supports the network adapter driver, and that they have sufficient memory and hard disk storage to accommodate the operating system and drivers. And remember, to get the desired performance, you may need to replace the workstation altogether.

And a smooth road

Don't forget that you may need to upgrade your cabling infrastructure. Also, remember that new media will require new patch cables.

Wiring Closet Migration: Category 3 to Category 5 - to Category 6?

Today, users looking for high performance solutions/infrastructure in the wiring closet are faced with two alternatives:

- Invest in a strategic cabling platform, such as the SYSTIMAX® GigaSPEED® Solution, based on a high performance RJ-45 architecture that has been

designed both to serve today's needs and scale for future requirements that embrace high-speed technology options.

- Make a tactical decision based on an existing Category 5 or Category 5e solution that was originally designed to accommodate 100 Mb/s technology and is now being touted as a platform to support Gigabit technology using complex DSP techniques. The SYSTIMAX Power Sum Solution exceeds these latter requirements.

With wide-scale proliferation of Switch 10/100 technology in the workgroup environment, users will face new challenges in the area of providing Gigabit options within the LAN. Acceptance of Gigabit Ethernet as high-speed transport interconnecting the various Fast Ethernet workgroups is a natural next step. A strategic initiative within Avaya was to develop the GigaSPEED Solution with predicted increases in bandwidth requirements driving Gigabit technologies to the desk.

Avaya has recognized the need for migrating the wiring closet to switching and Gigabit using a scaleable set of options based on Avaya's SYSTIMAX architecture and leveraging Avaya's cable and connector technology. The key elements of this architecture are the Power Sum Solution and the GigaSPEED Solution.

**Backbone migration:
Copper to multimode fiber
- to singlemode fiber?**

The backbone network presents the greatest opportunity for fiber in the private network. Avaya's product advantages in multimode and singlemode fiber, such as higher bandwidth capability, lower loss, faster termination times, and greater density need to be coupled with apparatus advantages such as those offered by the LC connector system. With added bandwidth capability being placed in the horizontal LAN, the case for fiber versus copper cabling in the riser is an easy sell. And for those customers who are looking for additional future proofing, a hybrid multimode/singlemode fiber solution can be offered as a means of investment protection for little additional cost. Due to the hierarchical nature of the LAN and the "funneling" effects of LAN switching, the "need for speed" clearly grows the further one gets out from the desktop. The natural evolution for the general business LAN over the next 5 years will involve a migration to switched 10 Mb/s; shared and switched 100 Mb/s at the desktop; switched Gb/s capability first at the server interface and then in the building backbone; and finally switched multi-Gb/s capability in the enterprise environment. The backbone infrastructure portion will experience a similar migration over the same time period, with high performance UTP strongly positioned as the horizontal medium, multimode fiber gradually moving to singlemode fiber in the building backbone, and singlemode fiber in the campus. Avaya's OptiSPEED™ and LazrSPEED™ solutions offer high performance options for these fiber optic infrastructures.

Service cost

You may need help with all of this. Consider the cost of any outside services

you may retain to help you with your high-speed networking implementation. This will include contract programmers to help you enhance applications, network integrators to help you upgrade your servers and network operating system, as well as your switches and routers. Don't forget PC maintenance companies that can help you upgrade your desktop workstations. Finally, you may need to hire cabling contractors to help upgrade racks, risers, and patch panels in your wiring closets.

Staffing and staff development

Hiring and/or training staff to install and maintain a high-speed network is a significant expense. Because, as we have mentioned earlier, high-speed networking technologies are relatively new, chances are your current staff haven't been adequately trained regarding them. Therefore, before you dive into a high speed network implementation, you'll need to make sure that your staff has acquired the necessary skills both in troubleshooting and management. This means they need to learn not only how to physically connect devices to the high-speed network, but also to optimize drivers and operate management applications for the protocol.

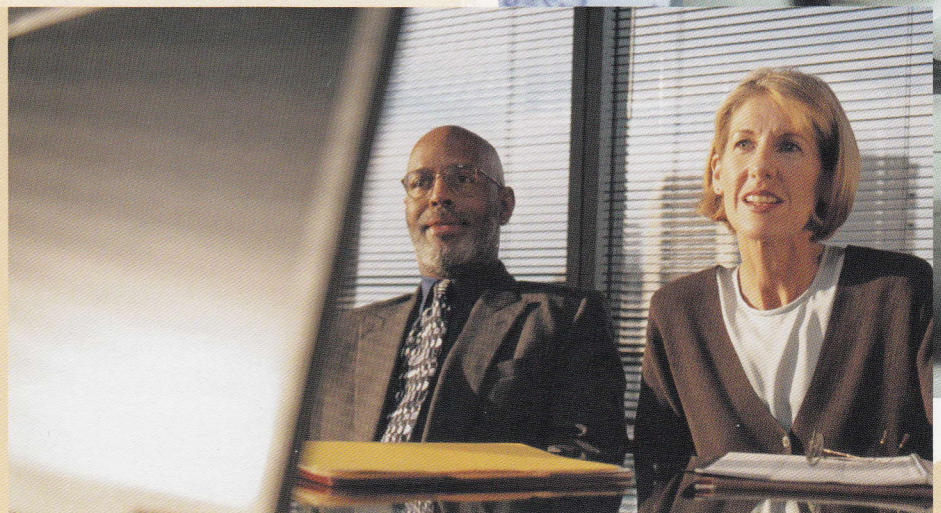
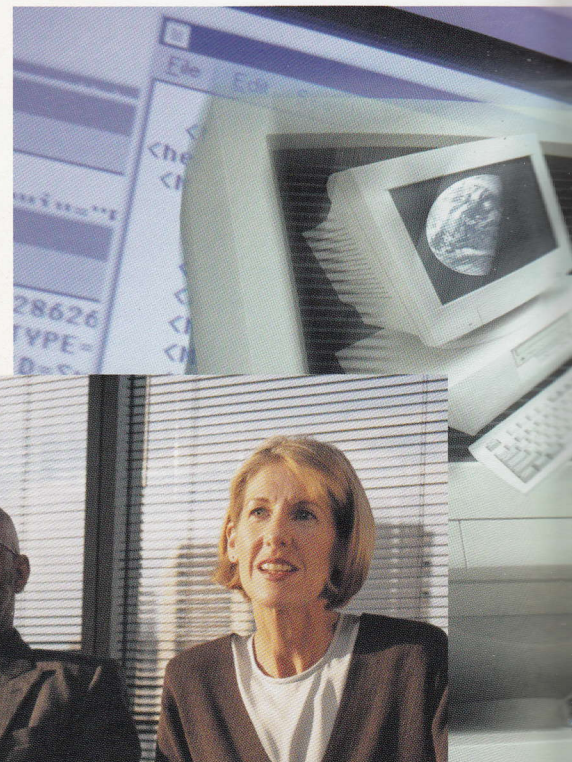
Preparing your staff to handle these responsibilities includes sending them to courses and seminars, purchasing books and other reference materials, and possibly hiring temporary staff to keep your network running while your regular staff acquires expertise in high-speed networking.

Sometimes developing existing staff isn't enough. You may even have to hire additional staff who are already experienced in high-speed networking. If that's the case, be sure to include recruiting and hiring costs into your implementation budget.

Time estimate

One of the hardest figures to estimate is that of time. Come up with an estimated time to upgrade each server, hub, router, workstation and switch; then, multiply that by the number of units of each piece of equipment you will convert.

Don't forget, the cost isn't limited to just time spent on the actual installation and configuration of your high-speed network. A major expense of converting your network protocol will be the costs of downtime, reduced productivity of everyone in your organization, while systems are being optimized, and the inevitable conversion problems being solved. Also the reduced productivity of your staff while they become comfortable with the new equipment, software, and systems. And don't forget the opportunity



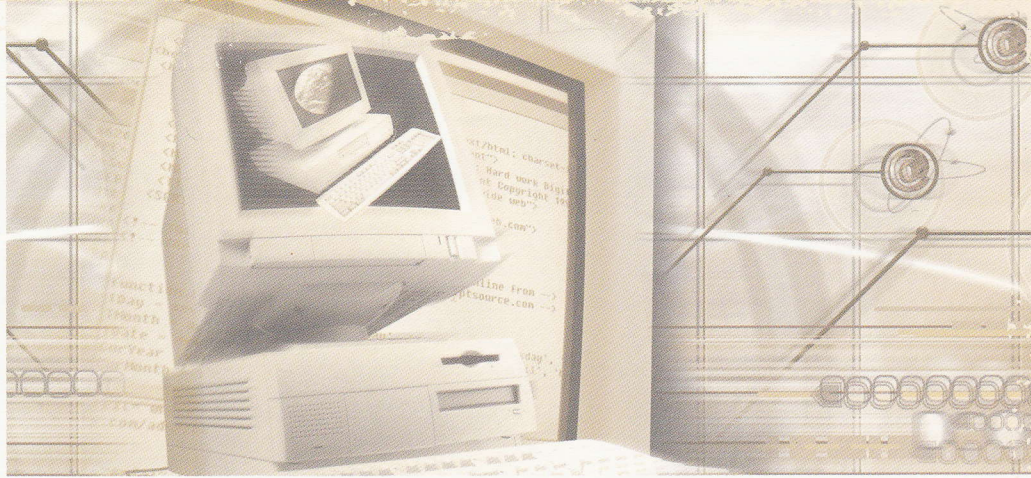
cost associated with the network conversion: what won't be completed well, or completed at all, while your staff is concentrating on implementing the high-speed protocol?

Applications

In some instances, you will need to upgrade applications as well as hardware. For example, you may need new network management applications to monitor and manage the new protocol. In the case of Asynchronous Transfer Mode, applications on both the clients and the servers may need to be upgraded to support the transport protocol. As well, if you will be upgrading the network and/or desktop operating systems, application upgrades may be necessary or desirable to get the required performance and support of the operating system.

Live fast, die young

Another issue to consider before undertaking a conversion to high-speed networking is the emotional cost. Whether it is worthwhile to install a high-speed network depends a lot on the condition of your company and your department.



As you will learn, implementing a high-speed network can be an expensive, laborious, time consuming, and nerve wrecking project. Therefore, if your company is in the midst of a reorganization, or a financial crisis, the stress of such a conversion will more than likely far outweigh its benefits.

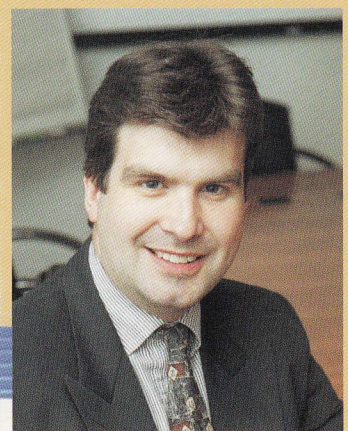
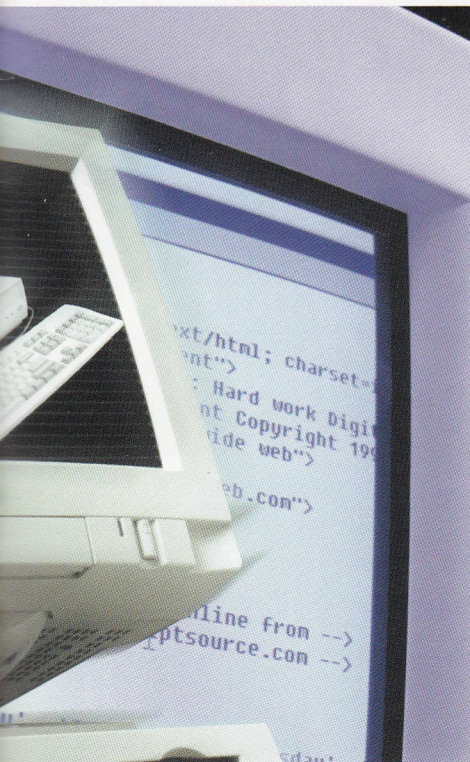
If you still find it's worth it

At this point you might be thinking twice about implementing high-speed networking. This article is not intended to scare you away from the idea, but to clearly highlight all areas that require consideration so that you can make informed decisions.

With SYSTIMAX SCS, Avaya takes away any concerns over the physical infrastructure. The SYSTIMAX brand name assures you of high performance, high quality products, designed with both the cabling standards and real applications in mind, but also with a view to the future. Cabling is required, by its nature and use, to last longer than other networking equipment, and with the SYSTIMAX Solutions you can buy and implement infrastructures today

which will enable you to choose when and where you implement high-speed networking in the future.

Okay, so you've figured in the cost of equipment, staff, applications, services, and morale, and it still seems cost-effective to implement a high speed networking protocol. Now it's time to get the budget and to plan the implementation. These topics, and more, will be covered in a follow up article in the next edition of LINK.



James Donovan

Strategy Director,
Connectivity Solutions, Avaya

James' role encompasses the strategic development of SYSTIMAX Structured Connectivity Solutions, incorporating product management and training.

Avaya Labs - Spearheading Innovations in the Enterprise

LINK talks to some of the key figures
from the SYSTIMAX® team at Avaya Labs

When Avaya was formed, the associated departments of Bell Labs became part of the new company. The same research teams that invented today's LAN infrastructure solutions, including SYSTIMAX Structured Connectivity Solutions, are continuing to drive innovation as part of Avaya Labs.

Avaya Labs may be a new name but it has a distinguished record going back more than a century. Alexander Graham Bell, founder of Bell Labs, patented the twisted pair for voice communication in 1876. His successors in this field now work for Avaya. They include Hal Friesen, acclaimed for his pioneering work on paired copper cable technology, which is the foundation of today's Category 5 and Category 6 solutions; Bob Conte, whose pioneering balun work proved to the world that UTP was suitable for high-speed data transmission, is also with Avaya Labs.



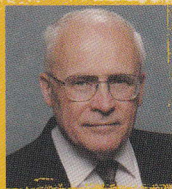
"We've seen cabling performance increase dramatically over the years, facilitating data rate increases from kilobits to Gigabits.

Our unmatched measurement and design tools will allow us to raise performance even further."

Bob Conte

*Distinguished Member of Technical Staff,
SYSTIMAX SCS, Avaya Labs*

The pace of research and development work in this and many other areas has accelerated since Avaya was formed. Investment in R&D, for instance, has grown from six to nine per cent of total revenue. This will further increase the pace of innovation for which the Labs are famous.



"There is more progress to be made in UTP technology. Work is underway at Avaya Labs to research further the factors affecting performance and to use this knowledge to deliver benefits to customers."

Hal Friesen

*Consulting Member of Technical Staff,
SYSTIMAX SCS, Avaya Labs*

When Avaya became a separate enterprise, all the people and facilities dedicated to LANs were transferred to Avaya Labs. This included R&D, strategic planning and standards specialization, as well as worldwide laboratory facilities.

Prominent among these specialists is Luc Adriaenssens, who is the author of the performance specification that became the Category 5 cabling requirements and was instrumental in shaping the Category 6 cabling requirements. He also played a central role in developing Avaya's GigaSPEED® and LazrSPEED™ Solutions.



"As well as the innovation and creative skills of Bell Labs, we have retained its potential for cross-fertilization of ideas.

Combined with our sharper focus on private networks, this puts us in a good position to increase our world lead in LAN infrastructure."

Luc Adriaenssens

Director of SYSTIMAX SCS R&D, Avaya Labs

Luc is now head of Avaya's SYSTIMAX SCS R&D department, developing copper, fiber and associated software.

In addition to Luc, many other members of Avaya Labs are active contributors to national and international communications

standards. Avaya Labs representatives can be found on committees at organizations including the IEEE, ANSI, ITU, TIA/EIA, ICE, CENELEC and ISO.

Distribution of news on standards to customers, BusinessPartners and account teams is directed by Systems Engineering Manager, Don Coover. Don, who has 30 years experience in the telecoms, data processing LAN and building controls industries, has served on the LAN and ISDN committees at BICSI (Building Industry Consulting Services International), and as a director of the Intelligent Buildings Institute.



"In the communications sector, where standards are so vital, it is essential to track developments closely. It is a key part of my

job to ensure any relevant information we gather is made available as quickly as possible."

Don Coover

*Systems Engineering Manager,
SYSTIMAX SCS, Avaya Labs*

Also prominent within standards organizations is Masood Shariff, Technical Manager in the SYSTIMAX SCS department at Avaya Labs HQ in Holmdel, New Jersey. Masood represents Avaya on building cabling standards at EIA/TIA. He is chairman of the important TR42.7 engineering sub-committee responsible for all copper cabling standards. His work has included development of the TSB 67 field testing standard and he is currently chairing the Category 6 standardization at the TIA.

Masood is also familiar to many Avaya customers and partners through his speaking engagements at conferences around the world. Such events are a central part of Avaya's future plans,

so customers can be assured that this valuable supply of information will continue to flow.



"Up to date information is essential to anyone purchasing, managing or maintaining network infrastructure. We will ensure that the Avaya user community remains the best informed as well as the best equipped in the business."

Masood Shariff
Technical Manager,
SYSTIMAX SCS, Avaya Labs

Working with Masood is Hans Ulrich-Roos, based in Switzerland. Among Hans' responsibilities, two are of particular importance. He coordinates Avaya's worldwide activity on standards, ensuring a unified approach that makes the best use of Avaya's expertise. A key part of this work is compiling the Avaya Standards Newsletter.



"Among my roles, I am Avaya's representative on the SB4 committee of the IEC, which meets in Switzerland. This has a brief covering

standards for passive network components, an area that includes every SYSTIMAX product."

Hans Ulrich-Roos
Manager International Standards
& Member of Technical Staff,
SYSTIMAX SCS, Avaya Labs

This publication contains valuable information on new developments and trends, together with explanations of their significance.

Another key figure among the Avaya Labs team is Dublin based Matias Peluffo, SYSTIMAX Technical Director for the EMEA region. Working closely with his Labs colleagues in the USA, he coordinates high level support for customers and is the central point of contact for technical teams in the field who need Avaya Labs' expertise.



"With the scale and sophistication of the facilities and expertise deployed by Avaya Labs in the region, no other cabling

manufacturer can match the levels of technical support we can provide to our BusinessPartners and customers."

Matias Peluffo
Technical Director EMEA,
Connectivity Solutions, Avaya Labs

Within Matias' area is the laboratory at Bray in Ireland. This is one of several Avaya Labs facilities in EMEA that are able to provide testing, development and other resources. These focus on needs specific to the region and are available to assist in work on customer support, standards and product development.

Another example of Avaya Labs resources is the extensive library of technical documents maintained by Bob Paradine. As Customer Liaison Manager, Bob also works closely with users, ensuring that information about their needs and expectations is constantly fed back to Avaya Labs.



"As a member of Technical Staff, I must provide solutions to customer problems when others have not succeeded. In effect, the buck stops with Avaya Labs Technical Staff and we have to provide the answers."

Robert J. Paradine
Customer Liaison Manager,
SYSTIMAX SCS, Avaya Labs

His great experience in network infrastructure is also put to use providing top tier support on complex communication challenges.

Gathering information to help enhance current Avaya products and develop new ones is a part of the job for most Avaya Labs Technical Staff. But for Steven C. Bartolutti, strategic planning and development of next generation offerings are focused responsibilities.

Based in Norcross, Georgia, Steven also heads a SYSTIMAX global technical support team. His team provides extra insight on how new products can meet emerging technical challenges and respond to the changing needs of business.



"As with Bell Labs, we are committed to driving communications technology forward and doing whatever is required to ensure our solutions deliver exactly what users need," he said. "We are a large organisation, but everything we do is ultimately driven by the evolving needs of our customers."

Steven C. Bartolutti
Senior Manager Offer Development
& Strategic Planning,
SYSTIMAX SCS, Avaya Labs

For more details on the SYSTIMAX Solutions developed at Avaya Labs visit <http://connectivity.avaya.com>.



Avaya Labs, Holmdel, New Jersey, USA.

Assuring your Peace of Mind

By Robert J. Paradine Jr., RCDD, Customer Liaison Manager
- SYSTIMAX® SCS, Avaya Labs



Bob Paradine provides an interface between end-user Customers, BusinessPartners and Avaya Account and Technical Support Managers for technical issues related to SYSTIMAX SCS.

Introduction

The SYSTIMAX® SCS twenty-year warranty consists of the Extended Product Warranty and the Applications Assurance Program. While attention is often focused on the Extended Product Warranty because of high visibility by the commercial building cabling standards bodies such as ISO/IEC and ANSI/TIA/EIA, the Applications Assurance Program is equally important. The movement of data is a mission critical requirement in today's business environment. This article explores the importance of the Applications Assurance Program.

Applications Assurance Program

The Applications Assurance Program covers the application(s) for which the system was designed to support, and includes both:

- Applications identified in the current SYSTIMAX SCS Performance Specification
and, importantly

- Any application introduced in the future by recognized standards or user forums that use TIA/EIA 568-A/-B or ISO/IEC 11801 components and link/channel specifications for cabling.

Avaya Labs can make this claim with confidence because our engineers participate in the development of all new cabling and application standards. Once an application standard is published and the endpoint electronics become available, Avaya Labs performs a series of proprietary testing to ensure SYSTIMAX SCS performance at its R&D laboratory in Holmdel, New Jersey. Upon completion of testing, an application guide is prepared that provides cabling system designers with a set of engineering guidelines that ensure the application operates as intended. SYSTIMAX SCS has a large resource of applications guides that provide design guidelines for most popular applications. This is also a source of comfort for most customers who have offices and factories in different locations because the design guidelines help to ensure uniform design.

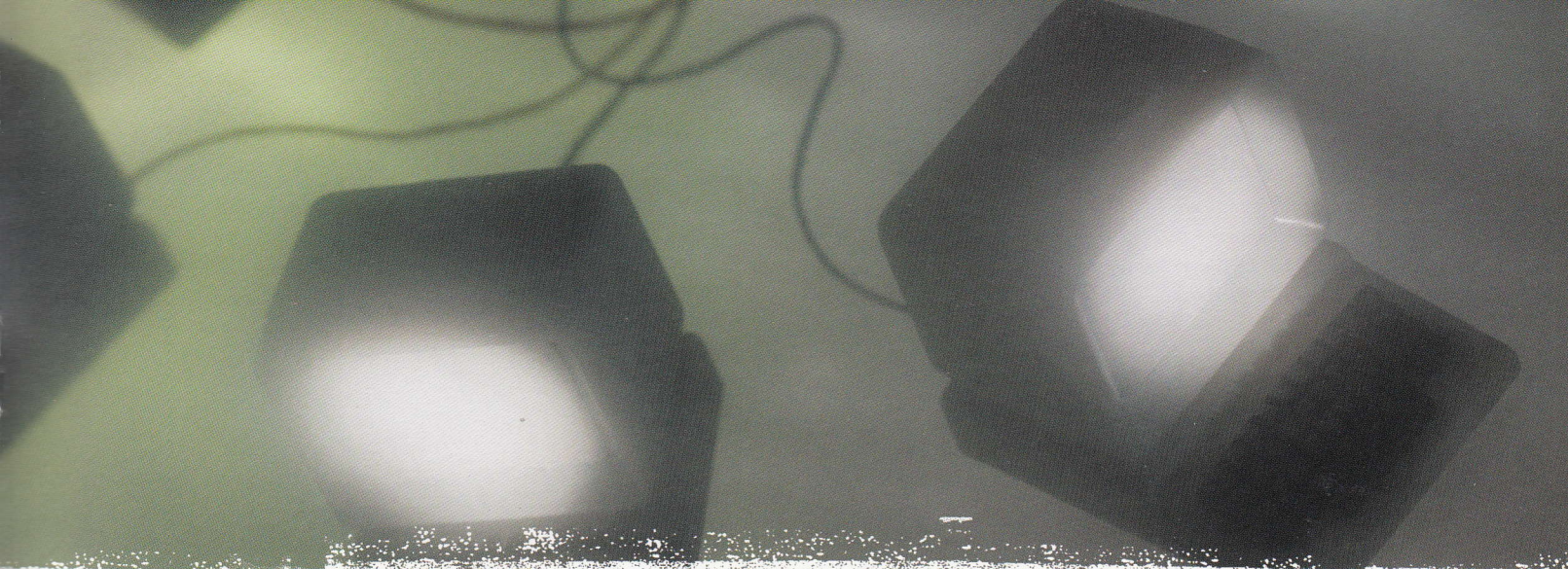
Background

When PC's and servers began to replace main frames in the mid-eighties, the Local Area Network (LAN) was introduced to provide a standard platform for the movement of data between defined user groups. The first unshielded twisted pair (UTP) LAN moved data at kilobit speeds and that was considered an astonishing technological feat at the time. The data speeds soon evolved to one, four, ten and sixteen megabits in rapid order.

The early LAN's used proprietary signaling and components and the cabling could not be used for another application. For instance, the 93-ohm coaxial cabling used for the IBM 3270 system could not be re-used for 10 megabit Ethernet because it required 50-ohm coaxial cabling. The user was forced to re-cable his entire building to run the new application.

The hub manufacturers were firmly convinced that only shielded twisted pair (STP) cabling was capable of reliably delivering data at high-speeds. LAN electronics that used Unshielded Twisted Pair (UTP) cabling were neither available nor even contemplated in the early days.





It was at this junction that the engineers from Avaya Labs, then Bell Labs, introduced SYSTIMAX SCS. Using UTP cabling and open architecture, Avaya Labs proclaimed that not only would SYSTIMAX SCS run current LAN applications but also future LAN applications that use ISO/IEC and ANSI/TIA/EIA cabling standards. Since the first generation of LAN's were developed for STP cabling interfaces, Avaya Labs developed an extensive product line of balun adapters to compensate for impedance mismatches. The Applications Assurance Program was introduced to complement the Extended Product Warranty as proof-positive that UTP was everything that Avaya Labs claimed.

Today's Environment

Since the STP versus UTP battle has been won and UTP is the overwhelming choice of users around the world today, is the SYSTIMAX SCS Application Assurance Program still relevant?

The answer is a definite yes!

Some of the main reasons include:

- Computer technology has and will continually improve to provide bandwidth intensive applications at faster speeds. The improvement from kilobit to Gigabit has happened in a relatively short span of time. The number of new applications including

full duplex Gigabit Ethernet over Category 6 cabling, digital video and building automation systems are looming on the horizon with many more anticipated in the future.

- The categorization of cabling that was introduced in 1991 has led to several levels of cabling performance which must be reconciled in order to ensure their ability to run new applications.
- The need to protect and future-proof your network infrastructure is even more important today since electronics are becoming more complex in order to run applications at high frequencies and Gigabit speeds.



Applications Assurance Program

- A Case Study

As an example of the benefit of applications assurance coverage, the following is an account of the response of Avaya Labs to find the root cause of a complex problem that a customer experienced when a few ports failed on his newly deployed high-speed LAN switch. The reason was not easily detected and the switch manufacturer claimed it was a cable problem.

Avaya Labs believed that the problem was caused by an electrostatic discharge (ESD) and dispatched engineers to investigate this occurrence. Most of us have experienced ESD when we came into contact with a metal object and received a "shock". The human body has the capacity to store very high voltages. Electric charges are transferred to the human body by friction. Because much of our clothing, rugs and furniture coverings are made from synthetic materials, electric charges accumulate until discharged.

Some materials also have the capacity to store electric charges. Electronic components as well as cables have this ability because of the materials used in them. Electronic components can pick up electric charges in the course of mechanized factory assembly by contact with machinery parts. Much like the human body, this can also happen to cables because of the friction created when they are dragged across the floor during normal installation. This is called a natural phenomena.

The engineers of Avaya Labs met with the customer, the switch manufacturer and the installation group to gather known facts. Tests were conducted to determine the remedy and immunity procedures.

Avaya Labs' ESD Experiment

Avaya Labs have conducted experiments to better understand an ESD event from charged cables and to study charge retention properties. An experiment was devised that used an ESD generator and tested competitor's Category 5, 5e and 6 SYSTIMAX cables as well as SYSTIMAX cables from other vendors. Figure 1 shows the laboratory set-up that was used in the experiment.



Figure 1. Cable layout on groundplane looking toward the ESD charging-end fixture

The experiment concluded that all the Category 5, 5e and 6 cables exhibit very similar electric charge retention properties. This is the expected conclusion since all of the cables are constructed from nearly identical or comparable materials. There was no new data found to suggest that the cables behaved any differently than when introduced in 1991. There had to be another reason why the ports failed since this same type of cable construction had been running applications without problems for a decade.

Next, the switch was examined to see if it played a role in the port failures. Investigation concluded that the board within the switch did not include transient voltage diodes (TVS) although the board was pre-drilled for their installation. Without the TVS diodes, there was no inadequate immunity from the effects of an ESD occurrence. Avaya Labs pointed out this finding to the switch manufacturer who then agreed to replace damaged boards at their expense, provided the necessary modifications to their board to add the TVS diodes. The problem was solved to the customer's satisfaction.

Engineers from Avaya Labs made a presentation to the BICSI Telecommunications Cabling Conference in January 2001 to educate the cabling industry on what to look for in LAN switches to ensure that they have adequate immunity to ESD events.

Conclusion

The above example clearly shows the continuing value of the SYSTIMAX Applications Assurance Program. Since the cabling previously passed channel testing, some vendors might simply argue that the fault definitely wasn't with their cabling and provide nothing further to resolve the customer's problem.

Not Avaya Labs. We take our responsibility seriously and have helped to set up a four-tier level of technical support for registered SYSTIMAX SCS cabling projects. Extensively trained local and regional SYSTIMAX technical support groups handle most requests for technical assistance.

Where additional technical support may be required to resolve highly complex problems, Avaya Labs provides the highest level of technical support. This final level of support from Avaya Labs ensures complex problems are brought to a satisfactory conclusion. Every time.

If you would like further information on ESD, an Avaya Labs white paper is available. Contact us at link@avaya.com to request a copy.

Developing the Next Generation of Copper Cabling Specifications

By Hans-Ulrich Roos, Manager International Standards
and Member of Technical Staff, Avaya Labs

Introduction

Currently several national, regional and international committees are working on the revision of existing, and the requirements for future, cabling standards. On an international level ISO/IEC JTC1 SC25 is working on the last drafts of the revision to IS 11801; in the US TIA/EIA TR-42.1 is developing the TIA/EIA-568.B editions and on a European level CENELEC TC215 WG3 is revising EN 50173.

Revisions include the development of new link and channel classes and component categories. At the time of the publication of this article none of the new categories and classes are ratified standards. The latest drafts of these documents are out for comment, and it is likely to take until the end of the year 2001 to finalize these standards, so that the documents may become ratified.

One of the major requirements for the new standards, was the introduction of enhanced cabling performances. New evolving applications will require more bandwidth and safety margins, so the groups needed to discuss where to set the limits for these requirements. Except for the US standard, in the existing international documents these limits were divided into two, respectively three, new categories and classes. In addition to the redefined enhanced Category 5/Class D, the new Category 6/Class E specified to 250 MHz and Category 7/Class F to 600 MHz. TIA/EIA only defines Category 5e and Category 6, as the US experts do not see the need or feasibility of a "Super-Category 7".

The following article describes the status of regional and international standardization organizations, especially in view of the new Category 6 and Category 7 proposals and will analyze the benefits and

disadvantages of Class E and F copper cabling solutions. It is intended to give a basis for decision on the class of cabling to choose for a new premises communication cabling project.

Standardization Committees

Standardization work is done in different groups who define the requirements for system application, communication infrastructures, component specification and test procedures. The following table shows some of the most important committees.

Status of Category 6 / Class E Standards

In this class, performance levels were limited to 250 MHz in bandwidth, as this was proposed as the highest level of performance for unshielded cables. Since the UTP base of installations in the world is more than 80%, the likelihood of higher requirements for copper cabling infrastructures is very low. The performance requirements for cables and connecting hardware are based on the channel and link performance requirements and are agreed in IEC TC46 for cables and in IEC TC48 for connecting hardware.

Group	Committee	Standard / Field of Activities	Area of Applicability
System Application	TIA/EIA TR 41.5	Multimedia	USA
	ATM Forum	ATM Specification	Worldwide
	IEEE 802.3	Ethernet Specification	Worldwide
	IEEE 802.5	Token Ring Specification	Worldwide
Infrastructure	TIA/EIA TR 42.1	TIA/EIA-568A	USA
	TIA/EIA TR 42.2	Cabling Infrastructure	USA
	CENELEC TC215	EN 50173	Europe
	ISO/IEC JTC1 SC25	IS 11801	Worldwide
Cables	TIA/EIA TR 42.7	Copper Cables	USA
	TIA/EIA TR 42.8	Fiber Optical Cables	USA
	CENELEC TC46X	Copper Cables	Europe
	CENELEC TC86A	Fiber Optical Cables	Europe
	IEC TC46	Copper Cables	Worldwide
	IEC TC 86A	Fiber Optical Cables	Worldwide
Connecting Hardware	TIA/EIA TR 42.7	Copper Connectors	USA
	TIA/EIA TR 42.8	Fiber Optical Connectors	USA
	CENELEC TC48X	Connectors	Europe
	CENELEC TC86B	Copper Connectors	Europe
	IEC TC48	Fiber Optical Connectors	Worldwide
	IEC TC 86B	Connectors	Worldwide
		Copper Connectors	
		Fiber Optical Connectors	

This equates to IS 11801 2nd edition. In TIA/EIA TR 42 the same requirements are already accepted, so that the TIA/EIA-568B version will be compatible with the international standard.

Category 6 Cables

CENELEC SC46XC has finally reached an agreement in the performance requirements for cables during its last meeting in January 2001, which is fully in line with the requirements of EN 50173. This agreement was based on a compromise found by IEC SC46C, in line with Category 6 requirements.

Category 6 Connecting Hardware

Excluding Return Loss, most other requirements are fixed, although connectors and plugs are still in a critical status since the standard can only guarantee intermateability but not interoperability and backward-compatibility. Most available Category 6 connectors have had limited testing to these requirements and no official reports for compatibility have been seen on the market. For a 'mix and match' strategy, which has to be achieved by any project resulting in a generic standard, this will

therefore be a major requirement to be met by the components. As already realized by TIA/EIA one of the most critical issues will be the quality of cords. With the introduction of Category 5e and Category 6, the days seem to be over, where a "wet string" could be used as a patch cord or work area cable.

Status of Category 7 / Class F Standards

Although most Class F performance requirements have been set to cover a bandwidth of 600 MHz, there are still open questions. Since the decision on the connecting hardware has not been made yet, it will not be clear whether the theoretical values used for calculation of the channel and link numbers will be kept by the recommended connecting hardware. In addition the usable bandwidth based on Power Sum ACR is only 475 MHz and not the claimed 600 MHz.

Category 7 Cables

The first cable types claiming to achieve 600 MHz performance requirements have been on the market since 1995. These products were using AWG 22 (0.64 mmØ) and were thick shielded twisted pair constructions with an additional common braid under the mostly used LSOH (low smoke zero halogen) jacket. Heavy competition in parts of Europe lead to smaller, and in regard to attenuation lower performing, products. Wire gauges were decreased to 0.55 mmØ, which resulted in poor attenuation performance. Because of different construction details amongst the cables, big variations in Return Loss performance can be seen in the products available on the market. Many installed cables may even fail performance requirements according to the current limits based on Category 5/Class D.

Category 7 Connecting Hardware

This is a very complex issue. ISO/IEC has chosen two products: one as the preferred option, claiming intermateability with RJ-45 connecting hardware and the other as a fallback product in case interoperability and backward-compatibility are not met.

Until now, no proof has been seen that the first product will meet the requirements. Since the RJ-45 type connector has not shown any signs of feasibility, it may very well be that the fallback solution will be chosen as the Category 7 connecting hardware. This would result in non backward-compatibility with lower Categories of hardware. A Class F solution based on this connecting hardware will require special adapter cables to all lower class applications.

Conclusion

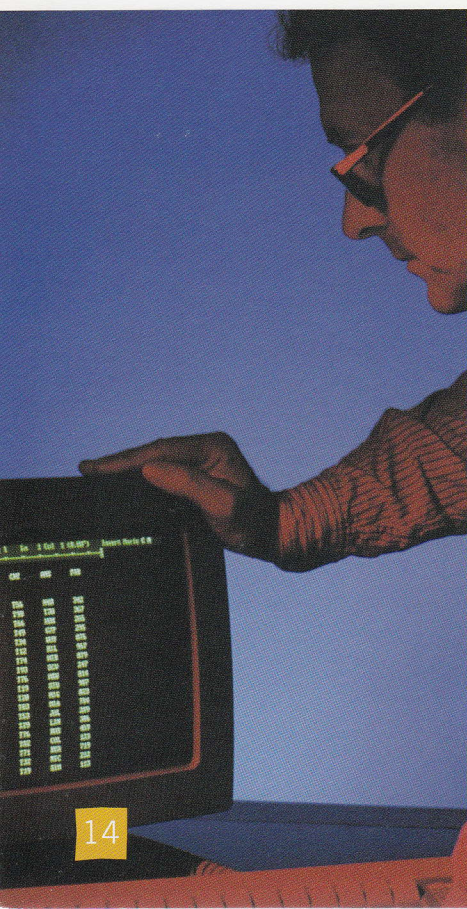
Looking at the status of standardization it may appear, that the only working solution available on the market is Category 5/Class D. This may be correct looking at the aspect for generic 'mix and match' solutions. Looking at the SYSTIMAX® GigaSPEED® Solution, all requirements for a working channel Category 6/Class E are being met. Even backward-compatibility with Category 5 and Category 5e is guaranteed so that SYSTIMAX customers can rely on a solid and proven solution for the future. The ability to supply all products from one source keeps the responsibility in the hands of one supplier. Add to that a warranty covering the channel performance for up to 20 years, as provided by Avaya, and this will give you the best insurance you can buy for your money.



Hans-Ulrich Roos

Manager of International Standards
& Member of Technical Staff, SYSTIMAX SCS
Development Team, Avaya Labs

Hans-Ulrich's role involves co-ordination of Avaya's worldwide activities on standards, ensuring a unified approach that makes the best use of Avaya's expertise.



It's Smooth Sailing for DHL's new Hong Kong Head Office

with Avaya's SYSTIMAX® GigaSPEED® Solution at its service

When DHL Hong Kong decided to move to its new headquarters in Cheung Sha Wan, Kowloon, it was critical for the company to use a top quality integrated cabling system for its high-speed data network—one that could be integrated into the company's current infrastructure while allowing for future growth and expansion.

"At our new headquarters, we had to integrate over 600 personal computers and printers as well as over 500 telephone sets into the system while maintaining the quality of service our customers expect of us" said Mr Ho Wai Chiu, Director of Information Technology, DHL International (Hong Kong) Limited.

Around 2,500 outlets are installed at DHL's Cheung Sha Wan headquarters, which covers an office space of 80,000 sq. ft.. An operation of such scale and workload requires a robust network infrastructure to support its high bandwidth applications.

"We needed a reliable system and we felt that the SYSTIMAX® GigaSPEED® Solution, incorporating the 110 VisiPatch™ system, was the right choice for us", added Mr Ho Wai Chiu.

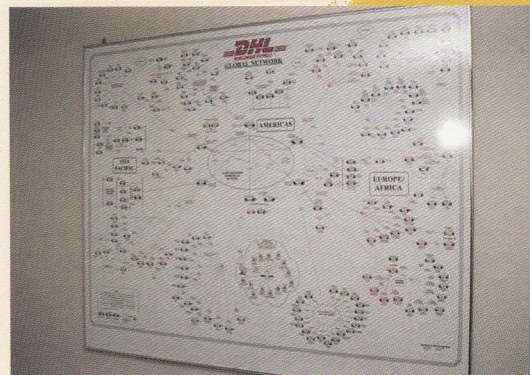
The VisiPatch system uses IDC (Insulation Displacement Connector) technology that features unique "reverse direction" patch cords, integrated cable management, and increased density to clean up clutter for a neat, cordless appearance. It's easier to install, easier to manage, more cost effective and consequently very efficient.

With the crowded environment of Hong Kong, where space is forever in short supply and at premium prices, the system's improved density is ideal to meet the need for space saving.

In addition to supporting its current operations, the 110 VisiPatch system has the capability to enable DHL Hong Kong to develop into multimedia and imaging. "The 110 VisiPatch system has the flexibility to expand in accordance with our corporate plan. We hope that in the future our customers will be able to see the actual image of the airway bill," added Mr. Ho Wai Chiu.

Imagine an operation running 32 overnight flights a week connecting Hong Kong and key destinations in Asia, thousands of field officers each sending back a sequence of data, with results returning within seconds. Imagine too all the invoices, airway bills, pending shipment status to track, plus complex eCommerce services. A powerful and reliable mixed media network is required to handle all this information traffic. The SYSTIMAX GigaSPEED Solution provides the perfect solution.

Why was Avaya selected? In reply, Frankie To, Operations and Technical Services Manager, DHL International (Hong Kong) Limited, remarked, "We are very satisfied with their products, technical support, and warranty. As the standard setting leader of technology solutions, Avaya is the obvious choice."



DHL Global Network Chart



Reception area of the new DHL HQ in Cheung Sha Wan



Mr Ho Wai Chiu

Director of Information
Technology, DHL International
(Hong Kong) Ltd.

University of Texas at Austin Installs State-of-the-Art SYSTIMAX® Solutions to the Desktop

New Applied Computational Engineering and Sciences Building has GigaSPEED® copper unshielded twisted pair cable, OptiSPEED™ singlemode fiber, and LazrSPEED™ multimode fiber to every desktop.

It all began with a vision

The vision was to provide an ideal setting for interdisciplinary research and graduate study in computational science and engineering, mathematical modeling, applied mathematics, software engineering and computer visualization. Avaya, the O'Donnell Foundation of Dallas, Texas and the University of Texas at Austin have created a thriving environment in which to train the next generations of scholars, scientists, and engineers. To create the best environment the state of the art equipment had to work on the initial day, have capacity for growth, ability to upgrade quickly and economically and be flexible enough to handle change and unexpected developments.

SYSTIMAX® is the connectivity solution of choice

The new Applied Computational Engineering and Sciences (ACES) building, benefits from the first highly advanced installation of Avaya's SYSTIMAX® SCS solution. The cabling solutions, running throughout support high-speed data transmissions up to 10 Gigabits per second (Gb/s) to and from the desktop.

The GigaSPEED® copper, LazrSPEED™ multimode fiber, and high bandwidth OptiSPEED™ singlemode fiber, are all a part of Avaya's SYSTIMAX family of products for building and campus networks and will give students and faculty greater flexibility in using high bandwidth data communications.

The LazrSPEED fiber-optic solution uses a short-wavelength, multimode fiber to transmit data at 10 Gb/s. Prior to the introduction of LazrSPEED, one Gb/s

transmission was considered to be the maximum capacity for practical multimode systems.

Avaya's GigaSPEED copper cabling has one of the highest bandwidths of any copper unshielded twisted-pair cable on the market, reliably supporting high bandwidth applications including Gigabit Ethernet, 1.2 Gigabit Asynchronous Transfer Mode (ATM) and all 77 channels (550 MHz) of analog broadband video.

The Applied Computational Engineering and Sciences (ACES) Facility is equipped with a highly flexible infrastructure consisting of 1.3 million feet of advanced cabling that can efficiently handle current communication applications as well as future innovations in technology such as imaging, streaming video and other bandwidth intensive applications.

The ACES building, constructed and donated to the university by the O'Donnell Foundation, is on the leading edge of academic computational facilities, with state-of-the-art equipment and systems. Among its feature attractions is the Visualization Research Laboratory, a 2,900 sq. ft., high performance interactive facility that uses a 10 ft., 180 degree cylindrical projection screen with images generated by an SGI Onyx2 supercomputer. The lab will be used by students to analyze large graphic data files that reveal minute particles in several dimensions. An electronic seminar room contains 42 seats with remote distance learning, advanced video and teleconferencing capabilities. In addition, power and an Ethernet port are provided at every seat.

The new ACES building has a 196-seat auditorium called the Avaya Auditorium. It features power and Ethernet network connections at every seat. It features a user-friendly audiovisual presentation system, with distance learning capability and a Dolby® digital sound system.

In noting how Avaya's SYSTIMAX solutions enable the delivery of high-speed communications, Kurt Bartelmehs, program manager for Instructional Technology at the University of Texas at Austin stated: "Avaya's cabling solution is flexible enough to support high-speed data transmissions for a variety of communications. The SYSTIMAX solutions meet our goals for the building to give us enough flexibility and capacity to handle any communications application available today and have lots of room to grow for many years to come."

"Avaya is delighted to supply such a noted institution as the University of Texas at Austin with one of the most advanced and flexible cabling solutions available today," said Dave Phillips, Vice President of Connectivity Solutions Worldwide Sales for Avaya. "The ACES building is state-of-the art and our SYSTIMAX solutions are providing students and faculty unlimited possibilities for the fast delivery of the data that they need in this innovative and challenging environment."



University of Texas at Austin, USA.

Throughout the Building

- 16,500 sq. ft. of lab space designed for maximum flexibility and reconfiguration
- 14 networked seminar rooms
- Videoconferencing capability on every floor
- 27 fully equipped offices for academic and industry visitors
- Open discussion areas and collaborative spaces on every floor
- 32,500 gross sq. ft. of shelled space for future expansion

Advanced Research Programs Housed in the Building

- Visualization and Graphics
- Software Engineering
- Simulation Based Engineering
- Center for Fluid Dynamics
- Interdisciplinary Mathematics
- Numerical Analysis
- Subsurface Modeling
- Intelligent Systems and Robotics
- Computational Finance

Telecommunications System

- Designed to support bandwidth intensive research
- Designed to support changing technology
- Advanced network design by Intel
- SYSTIMAX Copper and Fiber Optic cabling solutions by Avaya
- Fiber to the desktops, labs and seminar rooms
- Gigabit copper cabling to all rooms and labs
- Reserved conduits for additional systems installation
- Cable trays and raceways for flexibility, expansion room and easy installation
- Provisions for wireless environment
- Separate generator system for increasing power and cooling as needed
- 100 percent excess capacity built in

Avaya Infrastructure Supports Sun's™ £200m Super Campus

SYSTIMAX® GigaSPEED®, OptiSPEED™ and LazrSPEED™ Solutions provide connectivity for hot desking system with 1,500 users.



At its new Guillemont Park campus in southern England, Sun Microsystems™ is making full use of its own Sun Ray™ hot desking architecture. By using high-speed communications links to access files and applications on central servers, this is giving employees maximum flexibility in where they work. Sun Ray appliances provide screens, keyboards and access software. All of the other computing resources required to start work arrive via the network.

By enabling employees to use any available desk, this approach reduces hardware costs and office space requirements. Its success, however, depends on the performance and reliability of its network infrastructure. To provide the quality of connectivity that was needed, Sun decided to make Category 6/Class E cabling a standard for its desktop connections.

IT Operations Manager for EMEA, Dave Kimber, responsible for Sun's communications infrastructure at Guillemont Park and across the whole of the Europe, Middle East and Africa region sees this standard as a key part of the new campus.

"The site and its systems are designed to give departments maximum freedom to organize in the best way," he said. "Cabling infrastructure plays a vital part since the desktop is kept simple and the network delivers most of the computing resources."

Voice and data cabling for the site, together with switches and multimedia messaging are all being provided by Avaya. Avaya's SYSTIMAX® GigaSPEED® UTP copper solution was selected for connections to desks and SYSTIMAX LazrSPEED™ multimode fiber for risers. Communications rooms on each floor of the site's two and three story buildings contain GigaSPEED 1100 patching hardware with RJ-45 connectors.

This SYSTIMAX cabling now interconnects a range of other Avaya products at the campus. These include the CentreVu® Call Management System, DEFINITY® Enterprise Communications Server and AUDIX® Multimedia Messaging System.

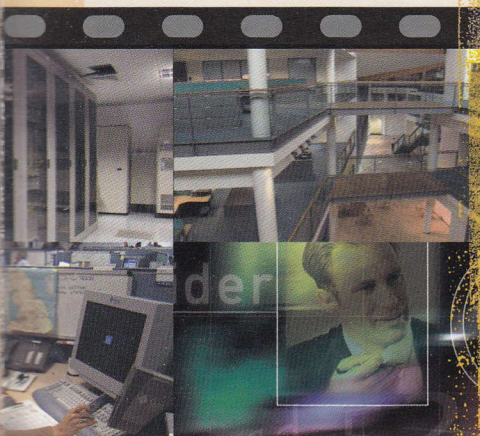
Sun was attracted by the GigaSPEED Solution because it is well proven at thousands of sites worldwide and fully compliant to the proposed Category 6/Class E standard. It provides 250% more bandwidth than Category 5 cabling and

will comfortably, and cost effectively, support high-speed networking applications such as 1000BASE-T Gigabit Ethernet. For an extra margin of fire safety, Sun chose to use the LSZH (Low Smoke Zero Halogen) GigaSPEED cable.

The LazrSPEED Solution, optimized for transmission in the 850nm band, provides throughputs of up to 10 Gb/s in the backbone without the need for very complex electronics. For longer connections, between buildings, SYSTIMAX OptiSPEED™ singlemode fiber cable is used.

Currently, most of the Guillemont Park site is served by 100BASE-T Ethernet. As well as providing upgrade potential to 1 Gb/s and more, the GigaSPEED Solution also gives immediate benefits in the form of faster file transfer and higher quality streaming media at 100 Mb/s.

"We use Avaya's infrastructure throughout Sun facilities in 23 countries across Europe and have found that it gives us the high end-to-end performance we need," said Dave Kimber. "It also has the advantage that all the components are designed to work together by one company so we get a complete solution from a single source."



About Sun Microsystems, Inc.

Since its inception in 1982, a singular vision, The Network Is The Computer™, has propelled Sun Microsystems, Inc. (Nasdaq: SUNW), to its position as a leading provider of industrial strength hardware, software and services that power the Internet and allow companies worldwide to dot-com their businesses. With \$19.1 billion in annual revenues, Sun can be found in more than 170 countries and on the World Wide Web at <http://sun.com> and <http://sun.co.uk>.

"Avaya products and people help us get the best from our systems," said Dave Kimber. "The end result is one of the most efficient office complexes anywhere in the world."

In all the buildings, the Sun Ray hot desking architecture will allow employees to sit anywhere that suits their needs on a particular day. To facilitate this, office space is divided into 'neighborhoods' areas where staff expect to meet with colleagues working in the same line of business.

When complete, the Guillemont Park campus will consist of five buildings with total office space of more than 46,000 square meters. Avaya Prestige VAR, Honeywell Network Solutions, will install cabling and switches for all of these. Honeywell, like Avaya has a long association with Sun, having carried out installations for the company at other UK locations including Bracknell, Bagshot, Cambridge and Coventry.

In the current Phase 1 of the project, Honeywell has cabled and connected two buildings, Java House and Solaris House. These house almost 1,500 employees in functions including sales, support, human resources, finance and legal. Phase 2 of the project, due for completion in the first half of 2002, consists of a further three buildings.

A total of 8,800 outlets have already been installed in the existing offices. Cabling is routed under floors in a segmented layout with multiple routes to the main server room in Solaris house. This provides the level of resilience needed by mission critical systems, including Sun's call center, which use the cabling network.

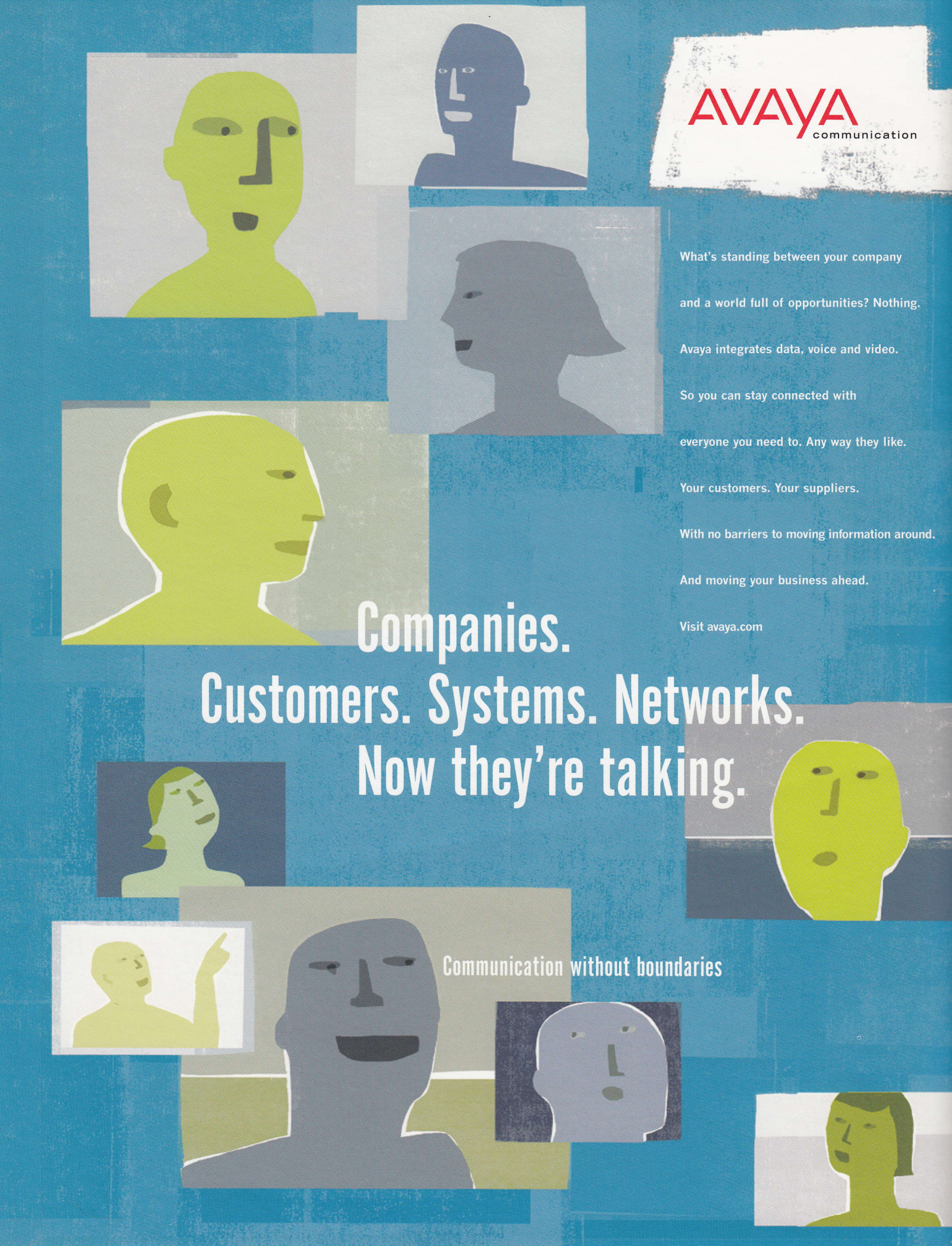


Guillemont Park Campus, Sun Microsystems, UK.

Employees can log-in to the system in any neighborhood and then move to another without logging out. All they need to do is remove and reinsert their Java™ smartcard and the network will reconnect them to their files and applications running on the server.

From when Sun purchased the land in 1998 to first occupation of the site in October 2000, the project has run smoothly. During this time, the work of all the contractors, including cabling installers, had to be well coordinated to make the project a success. In Phase 2, this will be even more important since the next three buildings must be brought on stream more rapidly than originally planned due to Sun's phenomenal growth rates in the UK. In the quarter before Phase 1 was completed, revenues grew by 66 per cent.

Dave Kimber believes that network infrastructure has a key role in sustaining this success. "Without cabling and data switches integrated to give the highest possible throughput, we couldn't achieve our aims," he said. "That is true today and will certainly be true in the future."



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