What is Open Architecture?

And, what are its advantages?

The purpose of this paper is to clearly and fully explain why network infrastructure solutions, marketed under a branded name and consisting of either one or two manufacturers' products, exist in the market today. This paper will also help illustrate why *open architecture,* a standards based network solution approach, is a viable alternative with numerous advantages to branded solutions. We at Proterial Cable Manchester believe that a well-informed customer will be less inclined to be influenced by marketing hype and more likely to make sound decisions based on fact.

A little history first…

To better understand what *open architecture* is all about, we must first review the history of local area networks and how they have developed over the years.

Commercially available local area networks, LANs, had their origin in 1977 with the advent of ARCnet. John Murphy of Datapoint Corporation developed ARCnet, short for Attached Resource Computer network. This network provided a data rate of 2.5 Mbit/s, supported up to 255 nodes and operated over common coaxial cable.

At the same time, Robert Metcalfe, who at the time worked for Xerox, was busy developing a network that would allow Xerox computers to share printers. The network he developed, with the assistance of David Boggs, would become what we now know as Ethernet. The first generation, known as 10Base5, offered a data rate of 10 Mbit/s over a distance of 500 meters.

In 1979, Metcalfe left Xerox to promote the development and universal acceptance of Ethernet. In 1983, the Institute for Electronic and Electrical Engineers (IEEE) released the Ethernet standard known as 802.3. Early versions of Ethernet ran on various cable types. It wasn't until 1990 that twisted-pair cable was selected for Ethernet.

As Ethernet continued to grow in popularity, the American National Standards Institute (ANSI), the Telecommunications Industry Association (TIA) and the Electronic Industries Association (EIA) collaborated to develop a wiring standard that would accommodate Ethernet and provide the manufacturers of cable and connectivity a benchmark to achieve in regards to construction, performance and testing of their products. It was believed that if all manufacturers built their products in accordance with the standard, one could safely assume that any jack, when mated to any cable, would provide the level of

performance indicated in the standard. This approach, referred to as *open architecture,* would grant end users the flexibility to choose from a variety of manufacturers and design a local area network that would meet their specific needs. Compliance to the standard would ensure that the final product would perform as required. In 1991, ANSI/TIA/EIA released the standard known as *ANSI/TIA/EIA-568 Commercial Building Telecommunications Cabling Standard*. The international cabling standard ISO/IEC-11801 is based on ANSI/TIA/EIA 568.

As the importance of networks became more and more obvious in the daily operation of most businesses, network performance also became important. Network electronics were proliferating and performance levels were quickly rising. As new, more powerful software came to market, throughput demands began to rapidly increase. More advanced versions of Ethernet were being introduced to the market, including 100Base-T which increased data rates 10-fold over the previous Ethernet version. Forward thinking end users also wanted to be prepared for the next generation of electronics so installing the best available infrastructure components seemed like a wise thing to do. To that end, manufacturers began to make infrastructure products that surpassed the performance requirements of the standards at that time. They also wanted to out perform their competitors.

To keep pace with market trends and to ensure that network infrastructures would be compatible with the latest network electronics, ANSI/TIA/EIA released 568-A in 1995. This standard was superceded by ANSI/TIA/EIA-568-B in 2001, and again just recently in February 2009 with the release of ANSI/TIA-568-C. For the purposes of this paper, we will refer to the current complete standard, 568-B, since not all sections of draft C have been released to date. By regularly updating the 568 standard, ANSI/TIA offers manufacturers an up-to-date benchmark to which they can build products and also provide consumers a quantifiable measuring stick in the form of test parameters with which they can compare products and thus make educated decisions regarding their network infrastructure purchases.

Once there were standards to build cable and connectivity to, manufacturers had to find a way to differentiate themselves from the competition. One way was for a company to offer a complete solution, or closed solution. This one company could provide the jacks, cables, patch cords, racks, etc. Another option was for a manufacturer to join forces with another manufacturer of a piece of the network infrastructure puzzle and jointly market their products. Typically, connectivity manufacturers partnered with cable manufacturers. These partnerships are also considered closed solutions.

The ANSI/TIA-568 standards also helped perpetuate packaged infrastructure solutions by stipulating performance requirements not only for the individual components, but for the installed end-to-end solution as well. The standards include performance requirements for the permanent link, which consists of the cable with connective hardware at each end. There are also channel requirements that add patch cords to each end of the permanent link. Since permanent link and channel requirements are established in the standards, manufacturers know how their products need to perform not just by themselves, but also

when used in conjunction with other infrastructure components. The obvious reason for this is to ensure the solution will support the applications intended to run over them. The channel and permanent link requirements are also very important to the manufacturers of hand-held testing devices since these manufacturers program their field testers to test to the requirements in the standard.

Field-testing, which is simply the testing of the finished product at the owners site, ensures that the products are installed properly and that they will meet the performance requirements established in the appropriate standard. With passing test results, the owner can be confident that the solution will support the applications that are appropriate for that solution, such as gigabit Ethernet over Category 6 or 10 gigabit Ethernet over Category 6A.

Closed Solutions Vs. Open Architecture

In network infrastructure, the term *open architecture* refers to the practice of using virtually any combination of standards-compliant components in the design of the network. The standard, ANSI/TIA-568-B dictates the performance requirements of the network components to ensure that they will accommodate the application that the end user wishes to operate through them. By employing the open architecture philosophy, the end user has the freedom to choose the products that best meet their specific needs and remain confident that together they will perform as intended. Just like a standard light bulb will fit into any lamp and work when you flip the switch, so will the network perform when you use components that meet or exceed the standards. This would appear to be the ideal situation. There is a wide selection of quality products available and if they all work together, then the customer/end user has virtually unlimited options when it comes to designing their network.


PCA, Manchester, NH

Of course there are also different levels of quality and performance to choose from in the market place. Certainly a wise choice, especially when it comes to cable for the infrastructure, is to select a company that offers guaranteed performance, a substantial warranty, such as a lifetime warranty, and has the personnel both internally and externally to properly support the customer. If an issue arises, it's good to have quick and easy access to the manufacturer. Other items that can contribute to confidence in a product's selection are if it is manufactured in the U.S. and if the company offers plant tours. Generally, companies that build a quality product are proud to show customers how they do it. This may sound a bit over the top, but if you're investing hundreds of thousands or even millions of dollars in your infrastructure, these are not trivial items.

Closed solutions, ones in which a specific cable and connectivity manufacturer are used, typically market the advantages that their solution offers over a standards-based solution.

There are a number of these solutions on the market. If standards-based solutions are the way to go, then why are there so many closed solutions? There are a number of reasons why this is the case.

The manufacturers in the closed solution may share sales representatives. Since many manufacturers use contracted sales representatives, if the sales representative sells the two lines in the solution, as well as other related product lines, the sales representative should be able to achieve a higher level of success. This can also help grow the relationship with the distributor. When manufacturers collaborate on a solution and promote some aspects of it, performance, warranty, etc. they hope to differentiate themselves from the competitors and increase sales. In actuality, the goal of the joint solution is to leverage the name recognition/market presence of both companies in a quest to gain market share. This may sound a bit nefarious, but in actuality, it's a very typical business arrangement. A benefit to the end user may be the fact that when they have questions on multiple infrastructure components, they may only have to deal with one company or one individual. Another perceived advantage may be the offering of an enhanced warranty. Seldom, however, is there any financial advantage to choosing a closed solution over an open one. We'll discuss this in greater detail further on.

Collaborative relationships between companies are not new, however. Intel, the highest regarded processor manufacturing in the world, partners with computer manufacturers, such as Dell, one of the best know computer lines, to help better promote their own brand name and as a result, they assist in the sale of more Dell computers. More Dell computers sold, more Intel processors sold. Proterial Cable Manchester does the same by promoting the fact that its fiber optic cables include optical fiber manufactured by Corning, the leader in optical glass manufacturing. When PCA sells more fiber optic cable, Corning sells more optical fiber. The relationships mentioned above are simply examples of when one product helps to increase the value of another and thus creates a net gain for both companies. What should also be considered is if that relationship actually provides any increased value to the end user. Is there a performance gain or some other advantage that can be attributed to the use of that product/solution?

Performance

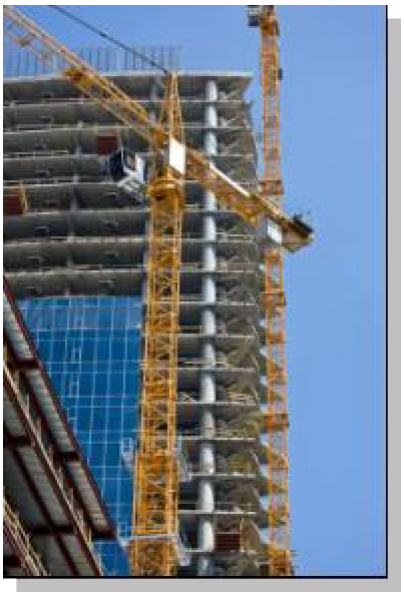
Is performance of the network infrastructure important? You bet it is. Studies have indicated that approximately 50% of network problems are related to the network infrastructure.

In the infrastructure, the cable is typically the most expensive component in the solution and it is certainly the most difficult to remove and replace. In fact, in many branded solutions where multiple options exist, if one were to compare the lower performing option to the higher performing option, they would find that only the cable has changed. All other components remain the same. The cable can also be a limiting factor when it comes to how well the network will perform. A poor quality cable can impede the transmission and reception of data

packets. The data will most likely get there, but the data throughput will not be optimum. With many end users, especially those that deal with financial transactions and medical records, poor network performance could be costly in a number of respects. Only choose well-known cables verified by a known third party such as Underwriters Laboratories (UL). Also, keep in mind that the network is only as good as its weakest link. So, any gains that could be achieved with high quality cable and connectivity could be negated by use of inexpensive patch cords.

When selecting an infrastructure, such as Category 5e, Category 6 or Category 6A, one should also consider the lifespan of the network. A network infrastructure should be able to accommodate today's applications as well as those soon to be released. By not choosing the appropriate category level, you could find that you have limited the future performance of the entire network. It may not seem to be a big deal now, but five years down the road when the latest network electronics come out, it would be a shame to learn that the infrastructure installed can't accommodate it. The thought of replacing the infrastructure with a new one may not sound too appealing to those in the finance department.

Regarding electrical performance, closed solutions will typically identify some perceived advantage that their solution offers over another. In reality, there may not be any discernable performance advantage provided by that closed solution over an open architecture based solution. The fact is that performance beyond the parameters of a particular standard, such as ANSI/TIA-568-B.2-1 (Category 6), may not actually aid in the performance of the network. The applications for which a particular category were intended to carry, such as gigabit Ethernet over Category 6 cable, will perform within the performance range stipulated in the Category 6 standard. The standards were written to provide performance above what is needed to support the applications running on them. Leading connectivity and cable manufacturers will build and test their cables to the appropriate TIA standard. So, if the listed performance of a cable or jack exceeds the standards, and the components have been independently verified by a reputable third party, such as UL, then it will support the application. If an end user, however, desires enhanced products for a specific application or for a particular installation, then those specific needs should and can be addressed. Additional performance, often referred to as "headroom", may be desirable due to a harsh or unusual installation environment.



The manufacturers in the closed solutions offer higher performing products than other companies. Right? In fact, recent PCA testing has shown that when some PCA cable products were mated to connectivity from the better-known solutions, the performance actually exceeded the published test data of the closed solution. However, it must also be pointed out that the same cable, installed in a different environment by different technicians, could result in different test results. The installation environment can play a significant role in product performance. So, before the infrastructure is installed, how can you be certain that you going to get what the marketing literature says you will get? Therein lies the

challenge. Some end-users request what is called a "bake off". This is when cable and connectivity manufacturers are invited to the customer's location to set up mock network links and test them. By inviting a short list of manufacturers to this challenge, the end user can directly verify what type of performance they are likely to get. Manufacturers that shy away from this opportunity may be the ones to avoid. Of course, when you start with high performance components, you are more likely to end up with a high performance solution.

Third-party Verified

Another item to consider is whether the electrical performance marketed by a solution or a component thereof is the result of testing by a known third-party or if it is generated by the manufacturers. Some manufacturers use the term "compliant" in regards to electrical performance. Though this may be acceptable for some components of the infrastructure, it may not be for others. What this typically indicates is that the cable's electrical performance was tested by the manufacturer, itself. Again, "compliant" electrical performance may be acceptable for some, but the credibility of the manufacturer and the performance level of the product(s) should come into question. *Verification* occurs when a third-party does the electrical testing of the cable then provides the manufacturer documentation of the results. These third parties, such as UL, will permit the customer, such as a cable manufacturer, to print the verification on the cable jacket. For example, the print legend on PCA's Category 6A Supra 10G cable reads, "*Verified (UL) Category 6A TIA/EIA 568-B.2-10*" which indicates it was tested and verified by UL to the Category 6A standard. Verified product performance is more desirable than performance that is compliant to a standard.

There is also a tendency in the network infrastructure industry to provide exceptional performance data for a particular product or solution and characterize that data as *typical* or *average.* These titles allow the manufacturers virtually limitless wiggle-room. Without a solid, guaranteed level of performance, they have very little to be accountable for. And, since handheld testers used by installers to test the infrastructure are preset to test to the limits of the applicable standard, performance outside of the test parameters can't be verified. For example, if a Category 6 solution promotes a particular level of performance at 300 MHz, it can't easily be verified since the field tester will only test to the maximum frequency of the Category 6 standard, which is 250 MHz. So, the claim can't be validated.

Listed is another term that is sometimes confused with *verified*. Being listed with a testing lab means the cable has been tested for safety purposes. National Electrical Code (NFPA-70) is concerned with basically two elements of a communications cable construction, flammability and voltage carrying capacity. The cable must carry 300 volts and be printed with the appropriate flammability designation, such as CMR or CMP. Testing by an NEC approved third part is required in order to obtain the listing and therefore be allowed to print the flammability rating on the cable. Electrical inspectors at construction sites look for these markings on cable jackets. If the cable has no marking or the wrong marking, it may have to be pulled out. The NEC is not concerned with how well the cables will accommodate gigabit Ethernet. So, regarding performance, you're on your own with a cable that is only listed and not verified.

As a note, compliance to some standards or initiatives, such as the *Reduction of Hazardous Substances (RoHS)* initiative is generally acceptable if documentation from the manufacturer can be provided to substantiate the claim.

Warranty

Every end user wants to be certain that the products they have chosen will be backed by a meaningful warranty. Most closed solutions offer a warranty carried by one of the companies in the solution, usually the connectivity manufacturer, and it covers the entire solution. The length of these warranties may be 15 or 25 years. Some even offer a lifetime warranty. These warranties are only available through a certified installer. So, in order to receive a warranty, the installation must be performed by an installer that has been certified by the solution manufacturer(s). This ensures that the work is done in an acceptable manner. This is, unquestionably, a good practice. Also, as part of their certification process, some companies offer training programs that can be quite informative. In addition to installers, some manufacturers will allow distributors, engineers and end users to participate in those training programs. A few of these companies have even had their training programs accredited by trade organizations, such as BICSI (Building Industry Consultant Services International), and can offer credits for attending their training. It goes without saying that manufacturers that promote the sharing of information and offer training programs are likely to be more responsive to customer inquires and assist them when necessary. Companies without those tools and personnel may not be as accommodating.

In regards to the warranty holder, it is still unclear why the connectivity manufacturers were the first to hold the warranties. In a typical infrastructure, the majority of the cost is associated with the cable. To analogize, it would be as if Goodyear Tire should hold the warranty on the automobile on which their tires are installed. The tires can represent a substantial percent of the cost of the vehicle, but as the owner, wouldn't you want the entity with the most at stake to hold the warranty?

The closed solution warranties can be comprehensive, but they can also be very restrictive. Virtually all closed solution warranties restrict future moves, adds and changes to the network in ways that are not always in the best interest of the end user. For example, representatives from some of the closed solution companies have been known to threaten end-users by telling them that if they integrate non-solution products into *their* solution, they could place the warranty for the entire infrastructure in jeopardy. One could argue that this restriction helps keep inferior products and or installers from interacting with the warranted products. It can also help exclude competition and ensure that the end user only buys solution products.

PCA believes the customer should have the freedom to choose the products that it desires. That is why PCA offers a lifetime warranty on solutions that include its cables and connectivity from over 20 different connectivity manufacturers including, Hubbell, Ortronics, Leviton, SMP and Hellerman Tyton. PCA has worked with these manufacturers over the years and is confident in their products' performance and the performance of a solution that includes their connectivity and PCA cables. And, when the solution is installed by an PCA certified installer, PCA will provide a Lifetime warranty on the entire solution. That's longer than many closed solution warranties. When a warranty of that length is offered by one of the largest and most stabile companies in the world, it's worth taking note of. Another feature of an PCA warranty that makes it unique in the industry is the fact that the warranty is transferable. By simply transferring owner information and providing updated test results, PCA will extend the existing warranty to the new owner. This feature provides significant value to those seeking to sell a facility and building owners who may need to replace a departing tenant.

Value

All marketing claims aside, the best infrastructure solution for the end user should be the one that offers the best value. Value is determined by looking at all aspects of the potential solutions, such as length and content of warranty, availability of materials, quality of certified installers, customer service reputation, product quality, product origin and, ultimately, price. Today, more than ever, companies are looking at a greater number of options before coming to a decision. Many companies who would have defaulted to, "buy what we used last time" are now altering their procurement habits. Companies are doing considerable research into their purchases to ensure they are actually getting what they paid for, especially if the option they are looking at is more costly than the others. And, this change is welcome by PCA. Does PCA offer an advantage over the closed solutions on the market? We believe so. Closed systems can cost more because competition is blocked out. Without competition, there's no need to provide better pricing. There's no need for anyone to sharpen his or her pencil. If a closed solution is specified for a project and only the products from those specified manufacturers can be used, is there any incentive for them to offer aggressive or even competitive pricing? They don't have to. They know they have the job. Open architecture invites all qualified parties to come to the table and show what they can do for the customer. When this happens, the one who wins is the end user. The result will be more options to choose from, more price points, and perhaps, even the discovery of a product that offers a better value than those previously being considered.

And, PCA is all about value. All PCA cables are U.S. made at the manufacturing facility in Manchester, New Hampshire. PCA customer service, engineering and quality are located at the Manchester, NH facility. All cables are built using the highest performing materials, including optical fiber from Corning. All category cables are UL verified for performance and guaranteed to exceed the requirements of the

appropriate standard. PCA utilizes trained, certified installers across the country and offers a transferable lifetime warranty on solutions including PCA cables and connectivity from numerous manufacturers. And, PCA offers BICSI accredited tours of our manufacturing facility and we'd be happy to have you come by. If you only want to install the most expensive solution, we know who to recommend. If you are looking for the cheapest products possible, we can give you their names as well. But, if you are seeking the best value in network infrastructures, you've come to the right place. We are PCA and we are the leader in open architecture.