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White Paper

TRANSITION NETWORKS®

7 Best Practices for Evolving Data Center Networks Utilizing Media Conversion

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The foundation of any data center network is the physical layer; the fiber and copper cables that connect users, servers, storage and, in the era of the Internet of Things, things. The always increasing demand on these networks requires data centers to constantly upgrade network size, reach, and throughput levels, which means frequently upgrading network equipment to the latest Ethernet standard.

Key trends such as virtualization, big data, cloud access and mobility are behind the increase in demand for bandwidth. And the network industry has responded with even more Ethernet variations, including new or emerging standards for 2.5 GbE, 5 GbE, 10 GbE, 25 GbE 40 GbE, 50 GbE, 100GbE and even 400GbE.

In this scenario of rapid change, media conversion is more important than ever to ensure connectivity, rapid service turn up and to maximize the cable plant investment.

The ultimate need is for data center operators to have the ability to simplify infrastructure while accommodating bandwidth growth. Media conversion technology plays a key role, but must be implemented correctly in order to facilitate network connectivity without impacting network management or data security.

Media conversion products have evolved over the years to help support these needs. From the early days of stand-alone, unmanaged, fixed configuration media converters, the industry now offers chassis-based media conversion systems that provide a central point of wiring, small form factor pluggable (SFP) ports that can accept any network interface, and secure management with alarms and web access.

Media conversion is a critical network system, but too many purchase decisions are based solely on data sheet information or worse yet, from price lists. There is a difference in media converters and a strategic way to plan and implement them. The following 7 best practices provide a glimpse beyond the speeds and feeds to other key factors to consider when adding or expanding a media conversion system.

1 - Best Practice: Convert Network Types at Physical Layer

In both multi-tenant telco or enterprise data centers, it's important to convert data at Layer 1 at the "meet-me" room or other area in the data center that serves as the demarcation point between WAN/MAN connections and the link to a customer's equipment cage.

Using a Layer 2/3 switch at this point in the network could lead to data co-mingling and potential for data to be intercepted by other customers. In addition, the packet processing involved in switching at this point can add up to several microseconds of latency to the connection. Many applications, especially those used by financial institutions, are latency sensitive.

Replacing the switch with a chassis-based media converter system maintains the direct link to the customer's servers while also dramatically reducing latency during the media conversion. Media conversion can be executed at any point in the network link, which enables data center managers to better leverage existing copper networks up to the full 100 meters even when data rates and network distances increase. This allows enterprises to install fiber-optic cabling only where absolutely necessary, in order to minimize the cost of the fiber network.

2 - Best Practice: Leverage OTDR-equipped SFPs to Detect Fiber Breaks

Fiber breaks are a significant component of the cost and manpower required to manage a fiber-optic network. Finding the break means tracing the cable all the way through the network. This can become an urgent situation because in many cases a fiber break reduces available bandwidth for data communications and, worse yet, could indicate that the network has been tapped and that data is getting into the hands of unauthorized third parties

Optical time-domain reflectometer (OTDR) technology injects a series of optical pulses into the fiber optic network and also reads the light coming back from the network. It either reads the light that is scattered or reflected back from a point, or points along the fiber. The OTDR instrument can then analyze these reflections to understand the change in the impedance of the cable which is analyzed to determine the location of the cable break.

Handheld OTDR instruments are available to be plugged into a cable when a problem is detected, but with today's 10Gbps or 40Gbps networks, detecting and fixing the break is time critical. To meet these needs, a new generation of "smart" SFP-based media converters has been developed to provide this OTDR capability. When a break is detected, the network manager can remotely initiate the OTDR functionality to rapidly detect the location of the cable break.

3 - Best Practice: Keep Management Data Secure

Another best practice, when it comes to data integrity, is to evaluate the security of network management data. Access to management data, while not compromising the integrity of the data itself, allows hackers to change configurations and potentially redirect data flows. Certainly a big part of protecting management data lies in ensuring that the network is physically secure; that access to network management consoles are restricted.

But the management system itself must also provide security. The first step is to ensure that system access is restricted by passwords and that access is recorded and available for investigation if necessary. This authentication must extend to all methods of access including remote web or telnet log-ins.

The next big part of a secure management system is protecting the data while in transit. Management systems should look for support of secure sockets layer (SSL) or secure shell (SSH & TLS) encryption on all management connections. Like most encryption schemes, an SSL connection is secured through the exchange of public and private keys. SSH works similarly but it encrypts the data twice requiring hackers to break two 128-bit codes before gaining access to the underlying data. Other secure management tools to look for could include a Management VLAN, support for 802.1x/RADIUS, and ACL Rules.

4 - Best Practice: Create a Separate Network for Physical Security of Data Center

One popular use of media converters is to extend network connections out to where a surveillance camera is located. For example, an exterior camera can be located in the ceiling or on an exterior light pole that is more than 100 meters from the network switch it connects to. By adding a media converter, the existing copper network cabling can be left in place while a fiber cable or another copper cable links to the camera. If the media converter offers retiming, the signal can travel another 100 meters to link to the camera. This challenge is repeated throughout the data center with network-connected badge readers, door locks and other non-IT systems. As more devices are added to the Internet of Things, a percentage of these will be connected to the wired network and will have the same challenges.

While it might be tempting to leverage the same chassis-based media conversion system for both data center information and physical security networks, the best practice is to keep these as separate as possible. One reason for this, is that video from surveillance cameras can consume a lot of bandwidth, slowing other data on the network.

This network separation also improves data integrity since connections to cameras are often outside of the data center's physical security, providing a potential attack vector for hackers.

5 - Best Practice: Make Purchase Decisions Based on Uptime Not Initial Price

It's important to get a cost effective media conversion system. But when taking the longevity of the products into consideration, it's much less expensive to purchase quality products that are managed because they will provide longer, problem-free operation. The time and money required to fix one failure can wipe out any savings made by buying the lowest price unit.

Things to consider when selecting a product with the best uptime:

- Quality rating: various firms offer quality ratings which measure how a product works out of the box and how it lasts over time. This is a good proxy for measuring uptime, so look for products in the 99.5% quality rating range.
- Network management tools should provide the information needed to make the IT administrators aware of network conditions that impact uptime. One key feature is packet counting, noticing changes in packet count can provide insight into data loss, network congestions, and broadcast storms. DMI statistics on the fiber transmitters can also provide valuable information on your fiber ports, providing advanced notice of a pending port failure, a link going down, or a trappable condition that needs attention.
- For fiber-optic networks, having diagnostic management information on the lasers is essential. This information can show how strong the transmit function is as well as the sensitivity of the receiver. Monitoring these statistics provides early warning of any laser problems.
- Another, perhaps softer, indicator is the company's history in the industry. A long tenure typically indicates a history of happy customers. Happy customers typically signify a company's expertise, ability to solve problems, quality products and reliable service. Select a solution provider with longevity and the proven expertise to improve network performance while leveraging existing infrastructure.
- When something does go wrong, it's important to fix it as soon as possible. Look for 24x7 customer support from trained engineers as a prerequisite for your purchase.

Considering the operating costs of your media converter system will help in acquiring a system that optimizes the total cost of operation (TCO).

6 - Best Practice: Build a Consistent and Repeatable Cable Infrastructure

Building out a cabling system can be a complicated and confusing undertaking especially with the magnitude of today's data center connectivity. It's important to develop and facilitate a standard, repeatable and consistent infrastructure in order to deliver the best performance and manageability.

This requires balancing cost and the distance limitations of copper cabling. One solution is to implement an all-fiber network, but the expense of this could be viewed as prohibitive. It's also somewhat restrictive as data centers must support the widest range of network types (Ethernet, and also T1, DS3, POTS, among others). Not all of these protocols define standards for transmitting data over fiber-optic cabling.

For most data centers, the right approach is to use copper where possible and leverage media conversion to introduce fiber-optic cabling where necessary. By building a structured cabling system, it becomes dramatically easier to turn up services quickly, begin billing sooner and manage the customer in a more comprehensive, consistent manner. This approach results in networks with more flexibility and scalability, allowing data center operators to cost effectively move many kinds of circuits around an entire campus, reaching long distances and across a network infrastructure, all while still achieving the high security.

7 - Best Practice: Support for OAM Protocols

For any application that requires service level agreements, seek a media conversion solution that supports operations, administration and maintenance (OAM) protocols. OAM protocols come from telco class equipment, but with the demand for service level agreements within data center networks, they are certainly an important requirement.

OAM examines information from the data link layer of each Ethernet packet to provide insight into link discovery, link monitoring, remote fault detection and remote loopback. This data is used by network management to verify connectivity, detect faults and monitor performance. Performance thresholds can also be set to trigger alarms when performance drops below a predetermined level.

The key protocol to compliment OAM standards is Y.1731, which has been standardized by the ITU Telecommunications Standards (ITU-T) section with additional interpretations work conducted by the Metro Ethernet Forum.

These best practices, combined with products that are designed with the right network technology, can make the correct and strategic media conversion decision a lot easier. For more information on media converters and how to pick the best solution, visit the Transition Networks' website.