The ABCs of Media Converters

Two Types of Media Converters

Ethernet fiber-optic communications provide many advantages over copper based Ethernet communications. These include immunity to noise and further distance capabilities. Systems that require fiber-optic communication can use switches that contain built-in fiber optic ports. However, if your switch does not have built-in fiber optic ports or does not have enough fiber-optic ports, then a media converter will be needed to convert copper based communications to fiber-optic communications.

In the market there are two basic types of media converters. A "True Media Converter" basically converts communications on a bit-by-bit basis. After one bit is received it is transmitted in the other format (copper or fiber-optic). This is in contrast to a switch which receives an entire frame of Ethernet before forwarding can begin. A non-true media converter, or *switched* media converter, is simply an Ethernet switch that contains one RJ-45 port (copper port) and one fiber-optic port. This media converter will wait for an entire frame to be received before forwarding can begin. Beyond the increase in latency that results, there can be issues when using switched media converters in redundant systems such as IEEE 802.1D RSTP or RapidRing®. Many converters on the market today are switched media converters.

Misleading Link Status Indicators

Another potential issue with media converters is the link status. In Figure 1 there are two media converters interconnecting two copper-only Ethernet switches. When viewing the Ethernet switches, one would believe that the link status displayed indicates the link status for the entire network between both Ethernet switches. However, with some media converters this is not true. A switched media converter will establish one link status on the fiber-optic port and another totally unrelated link status on the RJ-45 or copper port. If a switched media converter was used in Figure 1 and the cable between the media converters was broken, the link status at both switches would still indicate a proper connection. When using true media converters the switches in Figure 1 would be aware of a broken cable between the two media converters and not display a proper link on the ports connected by the media converters.

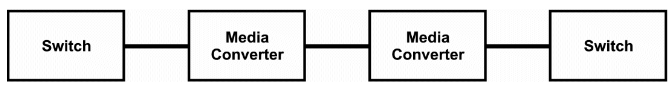

Figure 1

An RSTP Sample Issue

Not long ago a customer complained of a very long recovery time (from one to four minutes) for his RSTP network. He had connected two managed switches (which had no fiber ports) through four switched media converters (RSTP-unaware) to provide a fiber backbone. Figure 2 shows the network with the pertinent switch ports numbered. The RSTP protocol had forced the blue link inactive, making it the backup link. Then, to test RSTP performance, the customer interrupted the red link — activating the blue backup link. The fiber backbone is indicated by the green links. Analysis revealed that the unmanaged switch address tables were the source of the problem.

RSTP protocol had elected MS 1 as the root device, placing its ports 2 and 6 in the forwarding state. On MS 2, port 6 was placed in the discarding state to stop messages from looping through the blue link.

Contemporary Control Systems, Inc. • 2431 Curtiss Street • Downers Grove, Illinois 60515 • USA
Telephone 1-630-963-7070 **Fax** 1-630-963-0109 **E-mail** info@ccontrols.com **Web** www.ccontrols.com

Contemporary Controls Ltd • Sovereign Court Two • University of Warwick Science Park • Sir William Lyons Road • Coventry CV4 7EZ UK
Telephone +44 (0)24 7641 3786 **Fax** +44 (0)24 7641 3923 **E-mail** info@ccontrols.co.uk **Web** www.ccontrols.eu

October 2006

Broadcasts affect the address tables of all switches. This is true even if a switch is not serving any message path — as is the case with MC 3 and MC 4 while the blue backup link is inactive. Consequently, MC 3 and MC 4 correctly register both PC 1 and PC 2 as connected on port 1 of each device.

When the network topology is reconfigured due to an interruption of the red link, MC 3 and MC 4 become part of the communication path, but they will be ignorant of reconfiguration. Thus MC 3 and MC 4 will still try to forward all messages *to the left* via port 1 of each unit — although reconfiguration requires that messages from PC 1 to PC 2 flow through MC 3 and MC 4 *to the right* via ports 2 of each device. This means that once the blue backup link becomes active, messages destined for PC 2 will be lost until the address tables of MC 3 and MC 4 are corrected.

Switches "filter, forward or flood" received messages. Switched media converters behave the same way. They flood messages when the destination MAC address is not in their address table. They forward messages when the destination MAC address is in their address table. They filter messages (throw them away) when the destination MAC address is associated with the same port on which the messages arrive.

Message filtering was causing the problem for the customer. The solution was to use *true* media converters (having no address tables) that correctly pass link status between the managed switches.

Another problem could be caused by the network of Figure 2 when RSTP protocol is enabled. Under certain conditions, it is possible for message looping to occur when the link between a pair of switched media converters is disrupted and then restored.

It is unwise for RSTP networks to mix RSTP-aware switches with switched media converters that are RSTP-unaware. As can be seen in this example, sometimes the effects of such mixing can be impair network performance.

Summary

As seen in this article, significant differences in functionality distinguish the true media converter from a switched media converter. These differences could be crucial to the proper operation of your network. Both types of devices can be useful under varying circumstances. When in doubt about which type of media converter to use, consult your equipment provider. To help you in choosing appropriate products, Contemporary Controls EIMC devices are true media converters.

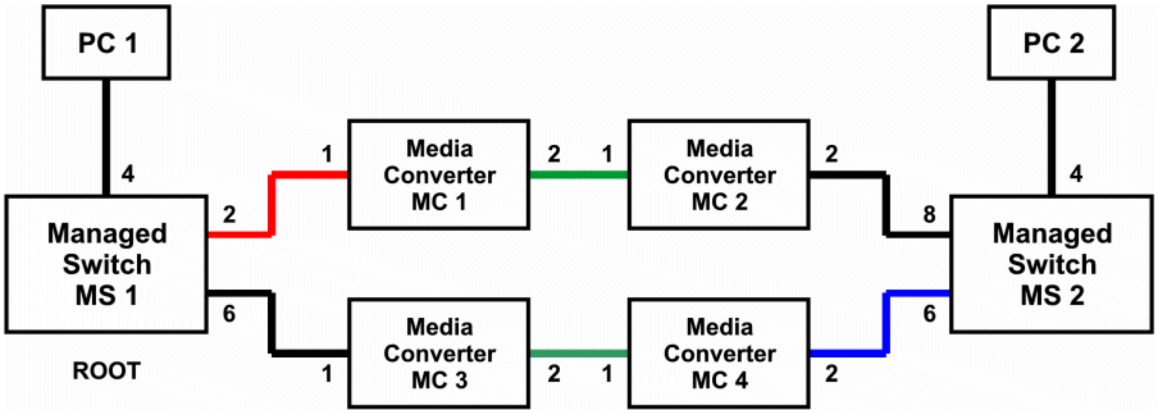

Figure 2