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## **Layered Transport Technologies and OAM: What is needed?**

More and more systems include multiple transport technologies working together, one piggybacking on the other. It only makes sense as the raw capacity of a wire or fiber goes up. You might have the traditional T1s within a T3 as in an M13 multiplexor or many T1s and E1s, or Ethernet packets within a SONET/SDH pipe. These technologies may originate or be destined for different networks and end users.

When considering the OAM (Operations, Administration and Maintenance) requirements in these situations, it can be confusing. Which technologies need to have the OAM capabilities? If I am really interested in transporting Ethernet, do I have to also have OAM on the SONET/SDH? These are important questions and the answers are critical to the competitiveness of the product and the satisfaction of the users.

The answer is that each piece of the solution needs its own OAM functionality. To help understand why, let's take a "simple" case of T1s within a T3 pipe. The reasoning is the same for Ethernet and E1 within SONET/SDH and any combination that might go into a network.

To make a T3 work, you need T3 OAM. To make a T1 work, you need T1 OAM. If they are together, you need both T3 and T1 OAM. Let's examine this scenario more closely.

The network looks at the T1s within the T3 as separate things, actually 36 different things: 1 T3, 7 DS2s and 28 T1/DS1s. These are different entities that each need to get managed. The T3, the 7 DS2 and the 28 T1 all have their own alarm states and performance monitoring data/statistics. One T1 can be in an alarm state while others are not. For instance, one T1 can send an RAI (Remote Alarm Indication) to stop being sent data as long as a defect exists for that T1 alone. There may be Service Level Agreements that depend on this information for support. All the information needs to be available to the network management.

The T3 is no different and maybe more important; the higher the bandwidth, the more disruptive a failure is likely to be. All of the T1s depend on the health of the T3 and DS2s to sustain transmission over that link. The network itself doesn't care what is being carried within the T3 in terms of managing and monitoring the T3. It needs and expects the T3 to be reacting to defects, declaring alarm states, sending alarms, collecting performance information and



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responding to loop back requests per T1.231. Period. It is pretty much that simple. The T3 could be carrying Ethernet packets, T1/DS2s or whatever. It is still expected to meet the alarm processing and PMON capabilities specified by ANSI T1.231. If a product is going to be used in a carrier or service provider network, nothing less is acceptable.

Some product managers and developers do not understand the advantages of these capabilities to their markets. The feedback of alarms and performance data will significantly help troubleshoot field problems whether by a carrier, service providers or end user. One example is a customer misconfiguring the framing format on the T3 where the equipment interface is configured for M13 framing and the network is configured for C-bit parity framing. Unlike T1, this does NOT result in an out of frame condition! This will show up as out of frames conditions in the 7 DS2 framers. Without the T3 OAM software processing this information, this will be difficult to find and correct.

Bottom line, both the T3s and T1s (and the Ethernet, SONET/SDH, T3 and E3) need to be standards compliant including meeting their respective OAM requirements. We don't believe the any product attached to the network will be competitive without it. At the very least, it will start off with a handicap.

NComm is happy to further discuss this with anyone desiring a better understanding before making this important decision.

**NComm, Inc.**  
**130 Route 111**  
**Suite 201**  
**Hampstead, NH 03841**  
**603-329-5221 Office**  
**603-329-5388 Fax**  
**ncomminc Skype**  
**[sales@ncomm.com](mailto:sales@ncomm.com)**  
**[www.ncomm.com](http://www.ncomm.com)**