Options and Standards for Monitoring of HFC Powering

Thomas H. Sloane*
Chief Technology Officer
(tsloane@alpha.com)

Hamid Qayyum#
Director Technical Marketing
(hqayyum@tollgrade.com)

Rob Anderson*
Director, Product Management
(randerson@alpha.com)

*Alpha Technologies, Inc.
3767 Alpha Way
Bellingham, WA 98225
phone: 360.647.2360
fax: 360.671.1040

#Tollgrade Communications, Inc.
7020 Professional Parkway East
Sarasota, FL 34240
phone: 941.373.6800
fax: 941.373.6887

Summary

Cable systems are already supporting services that rely on the reliability and availability of the cable plant. These services include video, telephony, and data, with revenue drivers such as video on demand (VOD), guaranteed quality of service (QoS) for commercial and business customers, internet and circuit-switched telephony, pay per view, gaming, and even everything on demand (EOD). With redundant fiber rings in metropolitan networks, route diversity across the long-haul networks, and resilient packet ring architectures (RPR), reliability is high in the transmission portions of the network, leaving the local loop, or last mile as the area most vulnerable to unplanned and unexpected interruptions.

Historically, network traffic consisted almost exclusively of analog video, a service that recovers instantly following a network outage. Traffic in the evolving cable network of today consists of digital data streams flowing between and among static and dynamic internet addresses for telephony services and cable modems, which creates a dramatically longer recovery time following even a brief outage. Packet voice service is very sensitive to plant outages since the voice packets cannot be resubmitted or recreated. With power fluctuations and/or loss, voice service would be severely affected leading to calls being dropped and the inability to place any type calls. To companies offering lifeline telephony services, this would be a catastrophic situation. Fortunately, monitoring of the conditions in the local loop, particularly power supplies, is undergoing a transformation with standards such as the HMS and new technologies such as DOCSIS®, providing better monitoring opportunities at a lower cost.

Processing, storage, and transmission of monitoring data in a digital format provides significantly improved data accuracy and precision, with a commensurate increase in value. During a power outage, the standby power supplies use power from the batteries connected to each standby power supply. Accurate measurement of the individual battery voltages is a requisite to creating accurate, real-time predictions of remaining run time (autonomy). Legacy monitoring systems, such as shown in the left of the figure below, use analog signals to transmit data from the power supply to the transponder and these analog signals are often corrupted by noise leading to poor or inaccurate real-time data.

Provided with accurate data, the status monitoring, both before a utility outage and during an outage, is valuable. Before an outage, status monitoring identifies faulty batteries, problems with connections between the batteries and power supply, or problems with the charging system. During an outage, the status monitoring system provides real-time information about remaining autonomy information that is critical to decisions on where to dispatch service personnel.

There are three principal monitoring systems in use today: legacy, HMS, and DOCSIS®. Legacy monitoring systems, such as shown in the left half of the figure below, are proprietary and thus do not make use of any established standards. The standards established by the SCTE HMS committee, first drafted in 1999, for the interfaces, products, and software involved in the monitoring of cable TV power supplies have motivated status monitoring manufacturers to created compliant products — products which also offer improved and expanded monitoring information. Most recently, transponder vendors have employed the power-supply-to-transponder HMS standard and the HMS power supply management information base (MIB) with a DOCSIS®-compliant transponder to create a new montoring option. Both

the HMS and DOCSIS® monitoring standards are illustrated on the right side of the figure at the end if this summary.

Legacy Monitoring. The majority of installed transponders use a proprietary analog and digital interface ,as seen in the left of the figure. The powering of these proprietary or legacy transponders is not standardized, and neither are any of the interfaces or equipment between the power supply and the monitoring software in the network operations center. Measurements obtained from the local display on the power supply or other local interfaces are different from the results displayed in the network management system.

HMS-Based Monitoring. A diagram for an HMS-type monitoring system is seen at the right side of the figure. In the complete paper, the overall monitoring system with the headend controller and hardware will be shown and discussed, too. The power-supply-to-transponder digital interface is defined by ANSI/SCTE 25-3 2001 (HMS 022) and includes power for the transponder. Because this interface is entirely digital, conversion errors are eliminated, and the HMS standard allows the operator to select any one of a number of HMS-compliant transponders. Furthermore, ANSI/SCTE 25-3 2001 defines data storage and organization with a MIB. Finally, there is an HMS standard for the headend controller, too.

DOCSIS®-Based Monitoring. At the power supply, the DOCSIS® approach is essentially identical to HMS monitoring. It is at the headend that the DOCSIS® monitoring differs from HMS. Monitoring with a DOCSIS®-based system has the benefits of HMS standardization (common MIB's, standard power-supply-to-transponder interface) with DOCSIS® physical and transport layers. Transponders can be interoperable among vendors. Most importantly, no headend controller or support infrastructure is required and the NMS is interoperable. Aside from power supply monitoring, there are additional features available by utilizing DOCSIS® transponders. Since these transponders have an IP address and utilize DOCSIS®, they can be treated as a multimedia terminal adapter (MTA) and can provide monitoring statistics such as jitter, packet loss, delay and mean opinion scores (MOS). Relating IP statistics with power supply and plant statistics, allows an operator to determine impact of physical layer issues on IP services and to isolate faults between customer premise, end-of-line, fiber node, and power supply. Data from power supply monitoring can integrate with data from operational support systems to tie in trouble ticketing and lower the mean time to understand (MTTU) for technicians and NOC administrators.

Residential customers are expanding spending and the increasing revenue streams for cable providers are based on higher-quality services such as telephony. Further growth with commercial customers will be based on similar high-quality services. Utilizing monitoring of power supplies and the value added features of IP monitoring, operators can provide a high QoS to their customers and achieve the business models they are striving to attain.