Status Monitoring using Cable Modems

Background:

Status monitoring for the cable television industry, until this point, has used a single frequency to transmit down the cable and a single frequency to transmit the data back. Cableware has been involved with this technique since 1982 when we designed the status monitoring system for Century III using an Apple computer. Later we designed the status monitoring system for General Instruments.

We still remember the day riding in a bucket truck in Hartford CT getting the reverse amplifiers balanced and having the technician ask "So what will this do for me, the guy that has to fix the stuff? I get lots of calls after hours and no one is on duty in the office after hours." I had to admit that it wouldn't do much for him in that case.

After getting 20-30 transponders on line with reverse amplifiers the noise floor began getting high. Fortunately they only had 20-30 transponders so the system worked but I began to wonder. The next system designed for General Instruments used multiple computers to poll smaller areas (now called hubs) and a master computer to poll that one (See March 15-18, 1986 NCTA Technical Papers, page 154).

The solution to the problem was to break the system up into smaller areas to control the buildup of noise on the return path and to use sophisticated error correcting techniques along with frequency agile, spread spectrum data. Obviously this was FAR to expensive to provide status monitoring. The solution would not come for another decade.

The Modern Cable System:

With the advent of fiber optics the typical cable system has broken their plant into many hubs. Data (video and digital) is sent via light through fiber optics to each hub site. From the hub site the modulated light is converted to RF where it is distributed to a small number of homes (500-1,000). This practice reduces the first problem of reverse noise buildup.

The infrastructure needed to support the Cable Modem is quite elaborate. Each cable modem itself is a powerful computer capable of high speed, error correcting, frequency agile operation. These first modems cost $800+ but now because of mass production the price has dropped near the $200 mark. In the next year or two cost should be below $100. Also involved are the data routers and servers, equipment and computers that are very expensive. On top of all that equipment is the necessary team of personnel required to keep such a complex system running.

This complexity could not be justified solely for status monitoring. However, if your system is offering cable modems then you already posses that complexity. Lets use it to send reliable data from point A to B and start doing some status monitoring!

The NetInformer:

The Cableware NetInformer is the device that communicates with the power supply(s) and in turn sends the data to the cable modem. The NetInformer has two programmable serial ports that allow it to communicate with up to 16 data acquisition cards (DAC's) at a time. The NetInformer uses a 10baseT Ethernet to communicate with the cable modem. Features are:

- Local serial port for setting internet properties
- Flash EEPROM for remote field updates if needed
- 10baseT Ethernet port
- Two programmable RS-485 serial ports
- Front panel LED's display Ethernet and serial port status
- Switcher power supply for wide input voltage (12-50 volts)

The NetInformer is polled by the NetInformer Server.

Cable Modem power supply:

Normally the Cable modem is powered from 120 volt line power. When power is interrupted at the power supply site we want the communications to continue. For this reason we have developed a small supply that converts the 60 or 90 volt output of the UPS supply to 120 volts to power the Cable modem.

NetInformer Server:

The NetInformer server is a rack mounted computer that polls the devices in the field and displays the data using a standard web page. The server is designed to be managed via the network. A local keyboard and VGA monitor is not required for normal operation, however they may be attached if desired for local control.

Features:

- The ability to monitor field equipment using a standard Web browser from anywhere on the Internet.
- Customer programmable alarms and limits.
- Sends e-mail and pages when major faults are detected
- Consolidation of the status of all devices of a particular class into a single status for monitoring by a primary network system, i.e. a single SNMP device.
- Eliminates the need for the main network management system to poll the devices monitored by the Cableware system.
- Provides a centralized repository for maintenance notes for each managed device.
- Provides authorized technicians with the ability to enable and disable fault reporting for devices being serviced.
- The system is designed to be extensible, additional equipment may be added easily.

Components:

- Rack mount Intel based server
- FreeBSD operating system
- Apache web server
- Perl scripting language
- CMU/UCD SNMP agent
- Custom Web pages
- Custom databases
- Custom CGI scripts
- Cableware status monitoring daemon
- Cableware SNMP agent

O/S: FreeBSD

- FreeBSD is a state of the art operating system for personal computers based on the Intel CPU architecture. FreeBSD is based on Berkeley 4.4 BSD, developed by the University of California, Berkley and its contributors. FreeBSD provides a "Rock-stable" platform and is used by many leading and highly used Internet sites such as Yahoo.

Web Server: Apache

- The Apache web server is the most popular web server on the internet. The June 1998 WWW server site survey by Netcraft found that over 53% of the web sites on the Internet are using Apache and its derivatives - thus making it more widely used than all other web servers combined.

Scripting Language: Perl

- Perl is an interpreted language optimized for scanning arbitrary text files, extracting information from those text files, and printing reports based on that information. Perl is widely used for CGI programming to provide the interface between Web pages and dynamic information sources.

Custom Web pages

- The provided Web pages provide three levels of detail on the current status of the monitored devices. At the highest level a count of the number of devices in a particular state is displayed sorted by area. Clicking on a particular area selects a more detailed view listing the status of each device in the area. Finally clicking on a particular device selects the lowest level view showing the real time status and selected readings from the device.

- The Web pages are templates that are used by the CGI scripts to generate the actual pages seen by the user. The customer may use standard Web authoring tools to modify the appearance of the pages as desired.

Custom databases

- Multiple databases are used by the system to generate the pages seen by the user, namely the top database, the area database(s), and the device database. The top database is an ASCII file containing a list of the monitored devices, locations, IP address and device IDs for devices in the associated area. The device database contains the maintenance notes and the fault reporting enable flag.

The customer may add or delete area definitions by editing the "top" database. The "top" database is completely optional, in simple systems the customer may elect to use an area as the high level view. Monitored devices may be added or deleted by the customer by editing the "area" database. Either of these databases may be edited using any editor capable of editing ASCII files.

The device database in not an ASCII file and may only be edited online using the Web interface.

Custom CGI scripts

- The CGI scripts provide the glue that binds the dynamic data collected from the monitored devices in the field with the Web page templates and the device database to generate the actual Web pages seen by the user. The scripts are written in Perl and source is provided. The script replaces tokens in the templates with either specified data from the device database, or with dynamic data collected by the status monitoring daemon. Since the appearance and contents of the Web pages are defined

by the template and not the CGI script, it is not necessary to modify the script to change the displayed information.

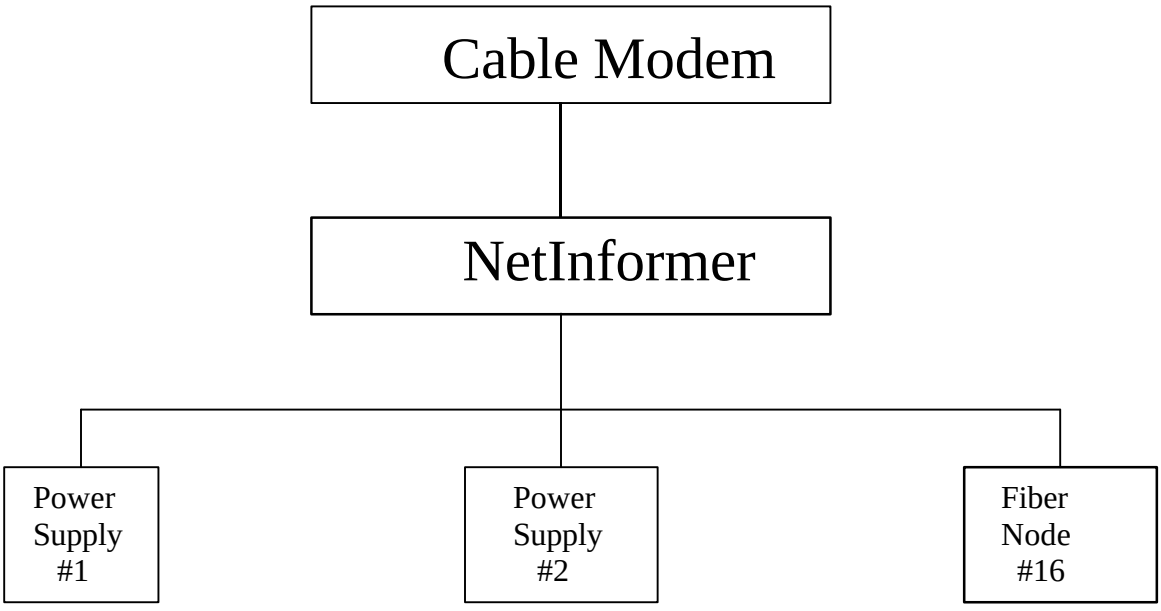
Status monitoring daemon

- The status monitoring daemon constantly polls the monitored devices at a defined rate. The daemon keeps a copy of the monitored parameters for each device in RAM for easy access. When the CGI script encounters a token representing a monitored device parameter it requests the value from the daemon. The daemon consolidates the status of all monitored devices into a signal status it provides to the system's SNMP agent upon request.

SNMP agent

- The Cableware SNMP agent provides a consolidated status code to the outside world representing the status of all monitored devices. One MIB variable provides a textural description of the failure for human consumption.

Block Diagram



Product Integration

Power supply type	Interface card needed
Alpha XM-9015	DAC-XM1
Alpha XM2	DAC-XM2
Lectro ZTT	NONE
Lectro CPR	Imbedded Transponder

Interface Card Description

DAC-XM1:

This card performs the interface from the power supply to the NetInformer. It is a small card that plugs on top of the APM card inside the Alpha inverter drawer. It converts the analog levels to a RS-485 serial interface so that up to 16 devices can be monitored with a single NetInformer unit. This card can ALSO perform with our Infrared Status Monitoring Gun so you can purchase and use this card to perform status monitoring BEFORE you have the cable modem system running.

DAC-XM2:

This card is the same as the DAC-XM1 but is made for the Alpha XM2 power supply.

Lectro ZTT:

This power supply is/can be equipped with software that communicates directly with the NetInformer. Since it is a dedicated, non RS-485 output, only two of these power supplies can be monitored with a single NetInformer. All that is needed in an interface cable.

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