

Status Monitoring, Performance Monitoring and CPE Monitoring

Examination of Watchtower Flux and CheetahXD

By Steve Day

When we look at monitoring in CATV, it is a very unique network and proposition. First, in exploring monitoring, we understand that it is a very different application than monitoring a telecommunications network or a commercial power network or a water utility network or a cellular network.

Characteristic	CATV	Telecom	Power	Water	Cellular
Use case	4 or more hours of service use a day	4 or more minutes of service use a day	Continual consumption pattern	On demand consumption pattern	Vacillating demand based upon user travel patterns
Outage manifestation - Company	Flood of complaints	Individual complaints	Physical observation of problem	Outages are not apparent (always)	Outages prevent communications
Outage manifestation - Consumer	Television service is off	Phone service is out	Power is out	Water is discolored or gone	Cellular phone service appears "all lines busy"
Frequency of Outage	Once every few months	Few times year	Once very few months	Few times a decade	Intermittent service unavailable
Consumer reaction	Upset	Conditional	Upset	Puzzled	Conditional
Monitoring and communications path	30% monitored, and communications in same network	90% monitored and communications in independent network	50% monitored and communications in independent network	Not monitored	30% monitored and communications in independent network
During outage, monitoring value	None	Mostly active	Mostly active	None	Mostly active
Major source of outage	Power supply	Cable failure	Transformers and surges	Broken pipe	Spike in usage, power supply

When characterizing the networks, the most important aspect of CATV monitoring is that communications is monitored in the same network path as the service delivery. Because of this; whether network, performance or CPE monitoring occurs, an outage renders all monitoring out of service. This is an important distinction because it suggested different values are placed. For instance, in telecom, power and cellular, the monitoring information is on a different circuit or network path relative to service delivery. In this case, outage and root cause analysis are very important. Telecom and Cellular can keep talking with their equipment, and in doing so; can actually start to make service restoral decisions without rolling a truck.

Water utilities are flying blind. Unless there is a geyser of water spewing from the ground, it is a hunt and search methodology that serves the day. It is perhaps the crudest way of monitoring.

CATV is in the middle. Because monitoring goes down when service goes down, monitoring has a completely different value. CATV monitoring is mostly used to identify preventive maintenance and to identify not-out-of-service conditions. CATV monitoring can detect power supply battery discharge problems or degradation of optical signal. Used properly, both metrics can foretell a future outage and a need for preventative maintenance. CATV monitoring can detect not-out-of-service conditions. Performance monitoring can look at the entire spectrum and detect slight changes in signal or carrier levels. By doing so, an individual channel problem (needle in a haystack) or a suck out (RF spectral defect) can be detected. Status monitoring can detect, for instance, an open cabinet or enclosure. This will ultimately lead to a catastrophic event, but does not directly impact service. CPE monitoring can use micro-reflections to predict structure integrity issues with connectors, cables or enclosures. The point here is that CATV monitoring, if managed properly can provide profound information that prevents out of service conditions.

Understanding the differences in status, performance and CPE monitoring is important. None are better than the other, and all provide very valuable information. CPE monitoring is an incredible tool because it uses a device (DOCSIS RF Modem) that is already in use. No additional equipment is required. Second, in even a moderately sized system, it provides 10,000's of data points. The goal is to look at the active data stream and extrapolate qualitative measurements to root cause events anywhere upstream for the residential modem. Armed with this data, and using complex event rules, a deductive process "suggests" a root cause problem with high accuracy.

Status monitoring is different. It is attached to power supplies, optical nodes or stand alone devices (end of line monitoring). It is oriented towards the detailed condition of a network element or network point. The metrics monitored are very detailed and oriented towards the health of the device. Second, in even a moderately sized system, it provides 100's of data points. The goal is to identify a specific device that is in distress or is degrading in its performance. These devices (transponders) are purpose built, industrially designed, and engineered to perform in harsh environments.

Performance monitoring is perhaps a hybrid of the first two. It is placement of a "probe" in a mission critical network point. This mission critical network point could be an end of line, a critical location, a neighborhood, a crime district, the boss's house or any other decision based point in the network. The sole purpose of performance monitoring is to analyze the entire RF spectrum and then deconstruct it to analyze the underlying carrier quality and then to deconstruct it to analyze the underlying video, data or voice service quality. Second, in even a moderately sized system, it provides 10's of data points. The goal is to create a spectral compliance test for FCC reporting, for technical knowledge or for ensuring quality of service. These devices (transponders) are purpose built, industrially designed, and engineered to perform in harsh environments. More importantly, they replace very expensive test equipment and procedures. So they also promise to save money.

Finally, with this said, what are the limitations of these three approaches to network reliability and quality of service.

CPE Monitoring

- CPE monitoring typically is not capable of full spectral analysis, and is more specifically only tuned to the DOCSIS channels that are active. Therefore, it could miss issues outside this spectrum.
- CPE monitoring traverses the most problematic element of service delivery, the in-home service drop and passive network. Therefore, projections deep into outside plant are always at risk.
- CPE monitoring is a consumer issue. It borrows bandwidth that the consumer technically has paid for and expects. Furthermore, the term Watchtower also has many consumers wary of privacy issues.
- CPE monitoring is not looking at the downstream pathway at all. It is basically using the equalization coefficient settings from the CMTS to interpret upstream signal characteristics and micro-reflections.
- CPE monitoring projects a distance to the problem in the outside plant. What it does not do is define that problem or identify the device that problem exists in.
- CPE monitoring provides an incomplete picture. It does not look at anything but the DOCSIS channel health.
 - It does not look at video channels.
 - It does not look at the condition of AC power.
 - It does not look at physical defects (open door, fan failure, battery defects, etc.)
- CPE monitoring is subject to inherent inaccuracies as it originates in an uncontrolled environment, the customer home. Consumer can unplug it, can introduce noise, can move it, can damage it. Status monitoring transponders are in controlled environments.

Status Monitoring

- Status monitoring specifically examines a network element, and does not look at the quality of service across the RF spectrum, in depth.
- Status monitoring can only identify problems that are occurring at the monitoring location or upstream from it.
- Status monitoring are individually and purpose-built sensors, that are not distributed at the same volume as CPE monitoring.
- Status monitoring can often be misleading, from an application perspective, if the network topology is not known. For instance, an outage is reported in 10 devices, but it is only the 2nd device that has a problem. It is simply impacting all of the other 9.
- Status monitoring does not provide a complete picture. By this, it is not located in the residence. Because of this, it is not typically at the ultimate end of line.
- Status monitoring is dependent upon equipment manufactures licensing, acquiring or building universally accepted (HMS/DOCSIS) transponders form a company like Cheetah. Many devices or manufactures do not have transponders available.
- Status monitoring is a purchasing decision not tied to revenue. As a cost, it is difficult to budget it in any universal MSO monitoring program. On the

other hand, residential modems are tied to revenue and therefore universally available.

Performance Monitoring

- Performance monitoring is relatively expensive and a complex examination of the RF spectrum. In many cases analog and digital. While it is very detailed, it is relatively expensive.
- Performance monitoring provides a detailed snapshot at a location, but it is not a fault isolation tool. Unlike CPE and status monitoring it does not isolate the problem to a location or network element.
- Performance monitoring is time consuming. Because of its detailed nature, it takes a relatively long time to scan through 100s of channels.