



**Return on Investment Analysis  
of HFC Performance Monitoring**

**Implementation of Cheetah Network Tracker  
and Cheetah Network Tracker PLUS**

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## Executive Overview

Do you derive a positive operational and financial outcome from performance monitoring of a HFC broadband network?

Most effective analysis begins with such a question. In the process of answering the question, one must acknowledge that there are many parts to this answer. At the top level, CATV companies are challenged to win and retain subscription-based customers. Competitors include network-based providers such as TelcoTV and Direct Broadcast Satellite. Competitors also include IPTV and over the top video (OTT) providers. With so much choice, customers are really faced with two propositions.

- ◆ Which service provides the best cost value offering?
- ◆ Which service provides the best quality of experience?



Figure 1. Cheetah Quality Matrix

In the Figure 1 illustration, what we see is a simple blueprint to customer service. The customer perspective is to be satisfied within the context of two measurements. The cost benefit relationship and the Quality of Experience. The matrix is not revolutionary, but it does start to provide a way to think about customer satisfaction.

The customer is always balancing a cost versus benefit "moment of clarity" against the "real time/ongoing" quality of experience within CATV products and services. The product in this case is mostly a converged voice, video and data solution. But never discount the intangibles such as good customer service, informed technicians and proactive quality assurance. What are the common characteristics of this thought process?

- ◆ Customers think about the cost/benefit relationship at points of stress. When they get a bill, when they face a budget crisis, when they are dissatisfied, or when they see a competitor's advertisement.

- ◆ The customer does not associate cost benefit with events, not a feeling. Outages, set top box failures, broken remote controls are all great examples of trigger events.
- ◆ The customer does not associate quality of experience with a feeling. Events are important, but there are studies that show the feeling of poor quality is typically a result of an impression over many events. Quality of Experience is an on-going, real time phenomenon.
- ◆ The customer does place significant value on intangible characteristics of cable television services including bundling, technology integration and simplification.
- ◆ Customers experience "moments of clarity." These moments really represent very positive or very negative service experiences. A call to customer service that devolves to the point that the customer says, "Just come and get your equipment, we are done here." A technician that does a tremendous job on an installation and the customer concludes, "I love my cable company, they really have great people working there."

Quality of experience is complex, and with this, General Management might inherently shy away from addressing these issues because of it. This hesitancy then re-enforces some level of indifference from technical operations. It is hard for the Technical Management to state that, "If my weekend shifts for emergency repair are reduced, I am vulnerable to Quality of Service problems, which will in turn impact QoE/customer satisfaction." The General Manager hears the statement, but cannot quantify it in the same manner as a cost/benefit trade-off.

This points to the dilemma, and the basis of an analysis that will demonstrate how adding network performance monitoring and quality assurance can create a positive outcome for the technical operations impact on QoE/customer satisfaction. It will also provide the tools to analyze this and place a positive ROI calculation on the investment.

### ***Network Performance Monitoring and Quality Assurance***

Although other white papers have explained this, network performance monitoring is something that Cheetah delivers via our CheetahXD status monitoring system. We install sensory devices in fiber optic nodes, power supplies and end of line locations. Specific to this analysis, we also manufacture products called the Network Tracker and Network Tracker Plus. While CheetahXD status monitoring systems test, monitor and alarm key network locations, the Network Tracker products do significantly more. They have the following unique attributes:

- ◆ They can be located strategically at any mission critical point in the network. They are self-powered and easy to install.
- ◆ They can be enabled or scheduled to do extensive testing of analog and digital carriers, on a channel-by-channel basis (Network Tracker – RF analog and DOCSIS data channels and Network Tracker Plus – RF analog, DOCSIS data channels, QAM digital channels).
- ◆ They can provide information that can be used to create a variety of technical, workforce and cost benefits.

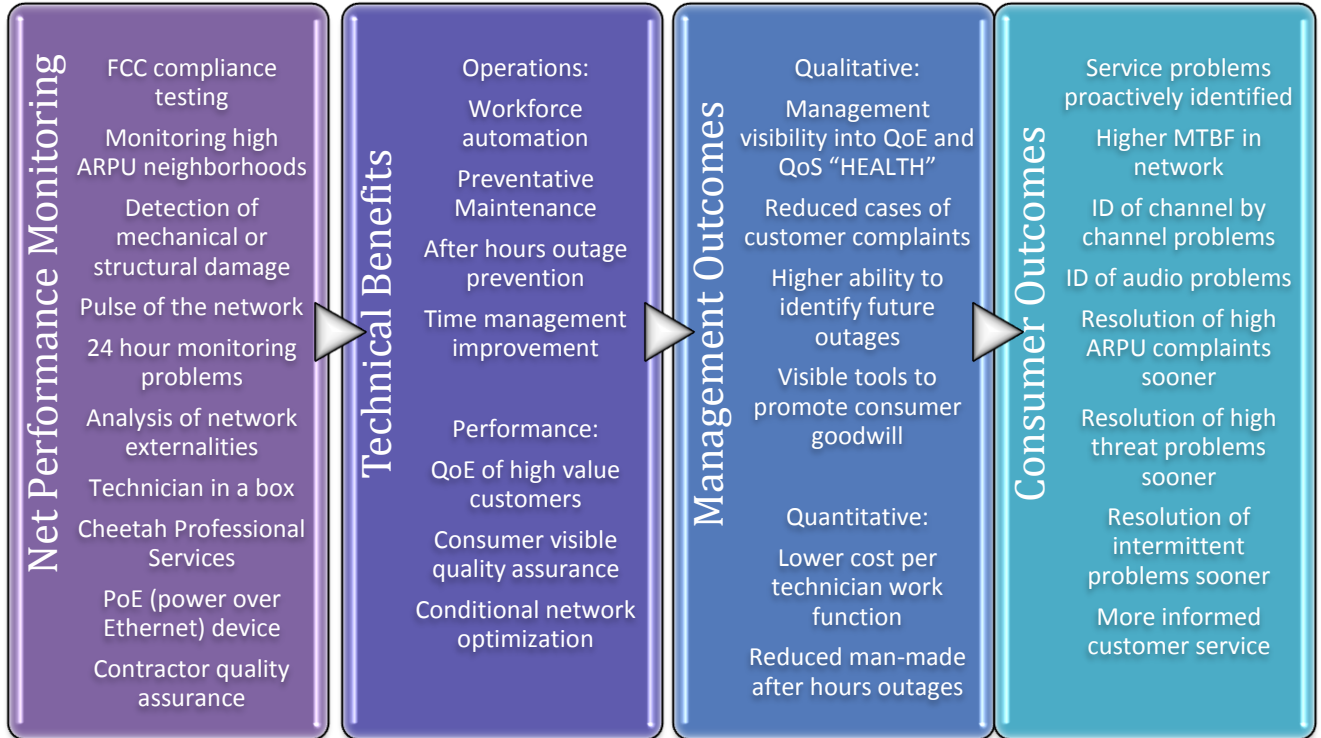
The quality assurance of the network, as it relates to Network Tracker and performance monitoring, is not a product. Quality assurance is the derived action of using the product. In fact, there are ten ways, and counting, that we can use Network Tracker to achieve quality assurance in the cable television operations.

- 1) Bi-Annual FCC network compliance testing.
- 2) Strategic placement of network performance monitoring in high ARPU (average revenue per user) neighborhoods.
- 3) Early detection of mechanical or structural damage to cables, connectors and housings.
- 4) Before and after comparisons over time and over distance to gauge the historical health (pulse) of the network.
- 5) 24 hour monitoring of high threat customers or troublesome intermittent problems.
- 6) Analysis of network externalities (temperature, moisture, wind) that allow for seasonal optimization in a programmed way.
- 7) Technician in a box, whereas the on-demand scheduling of the Network Tracker functionality replaces the need for a second technician.
- 8) Cheetah Professional Services employs our expert service of network performance management analysis to support the quality assurance program in a variety of ways.
- 9) PoE (power over Ethernet) device implementation is a broad functionality that can be used to provide an Ethernet WAN feature for the cable television network.
- 10) Contractor quality assurance, where the network performance monitoring can prevent contractors from leaving problems at the end of their workday.

This represents a wide range of ways that network performance monitoring and quality assurance can be combined. A sensory device being used as part of an activity to improve the quality of experience associated with cable television customers.

### ***Customer Quality of Experience***

With this said, it becomes important to correlate the network performance monitoring and QA activities that create customer satisfaction. In Figure 2, the performance monitoring is correlated to technical benefits, management outcomes and consumer outcomes. By illustrating this correlation, it allows the Technical Manager to begin analysis of network performance monitoring and quality assurance ... as it relates to QoE/customer satisfaction.



**Figure 2. Correlation of Quality Assurance to related outcomes**

This leads to highly productive insights and conversations about how to improve quality assurance leading to customer satisfaction. The idea is that customer satisfaction results in retained subscribers and higher revenues. The coupling of network performance monitoring, with a product such as Cheetah Network Tracker, results in an added dimension to quality assurance. In doing so, the specific questions and answers can be considered as exemplified in the scenarios below:

**Scenario A**

A suburban neighborhood has an affluent and high ARPU customer demographic. As part of technical operations, the decision has been made to place a Network Tracker at the end of line in the center of this neighborhood. Scheduled polling of channels and alarm thresholds are established. At 1:00 PM on a Thursday, an alarm is observed. A technician is dispatched to the neighborhood, and finds a partially cut cable. It is repaired by 4:00 PM. This bedroom community starts to arrive home at roughly 4:00 PM, and essentially no outages are reported. Customer satisfaction is preserved.

Outcomes: An outage being repaired before the majority of the most valuable and highest paying customers in the CATV system can experience it. It also prevented an after hours dispatch of technicians.

## **Scenario B**

A contractor is working in a fiber serving area, and as part of his contract, he installs a Network Tracker at the end of line. The dispatcher tests the network prior to him starting his network upgrade. At the end of the day, he calls in, and the network is tested again. It is observed that there are unwanted micro-reflections and/or frequency response profiles. The dispatcher cross-references an as-built map, and suggests the contractor check a specific RF amplifier. A loose damaged connector is fixed.

Outcomes: If this contractor had left, a service problem may have occurred after hours. After hours technical resources may have been required. More importantly, months later, an intermittent problem would have occurred, without being associated to the contractor's work.

## **Scenario C**

A customer has called several times to report a problem with audio levels and intermittent picture disruption. On three different occasions in the last month, a repair technician tested no trouble found. The person is on the phone and irate. The technical dispatcher explains that the company has a Network Tracker for analysis of these hard to find problems. A technician would install a set of Network Tracker devices, near and on the customer premise, to try to identify the problem. They could be left in place for 24 hours or more. Immediately, the customer is diffused from further anger. Over the course of the next two days, there is a discovery that a "suck out" condition is observed at roughly 3:00 PM every day. The customer states that only her son is home at that time, and asks him what he does to the television? He shows that he moves the set top to get to his video game connection. The technician suspects a defective wall plate and replaces it. The customer does not call back.

Outcome: The technician is able to isolate a problem that would have been impossible to find without a framework of the time of day it is first observed. The customer is seeing the cable company do pro-active troubleshooting with advanced technology. Technical resources are optimized. Customer satisfaction is restored.

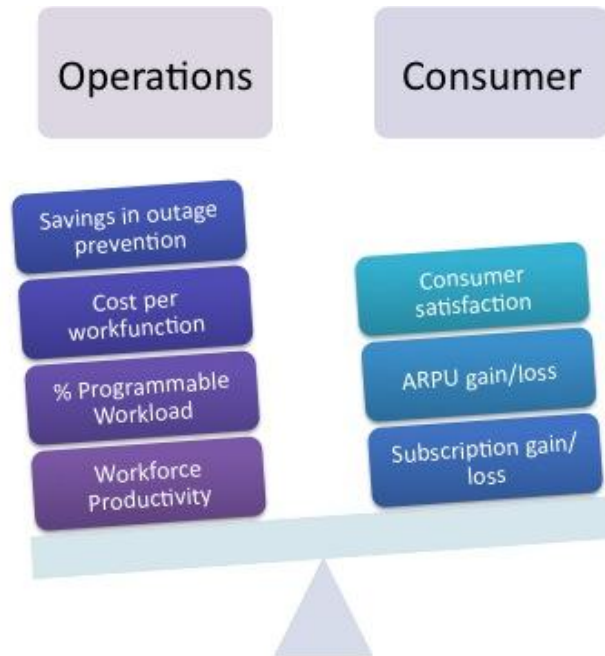
## **Putting it all together – ROI Analysis**

It would simply be presumptuous to build an ROI analysis that fits the cable television company model. Each cable television company is different, each cable television technical operation has different quality challenges, and each cable television company's customers are different as well. Cheetah would be happy to build an ROI analysis for each customer's particular situation and quality assurance program.

A more productive manner would be to attempt to create a decision matrix that is the basis of ROI, and ideally build an ROI calculator (or example) that reflects the way to look at network performance monitoring, as it relates to quality assurance. With that said, there are operations management outcomes and consumer outcomes that affect ROI differently. Figure 3 illustrates that this relationship is a balance between expense and revenue, productivity and customer satisfaction.

- ◆ Productivity gain creates a direct reduction in expenses and an indirect improvement in revenue.

- ◆ Customer satisfaction creates a direct improvement in revenue and an indirect reduction in expense.



**Figure 3. Quality Assurance ROI Relationship**

Why is this notion so important? It is important from a technical operations perspective because the most important aspects of the business are quality assurance and workforce automation. It is intuitive to think that network health, and the 24 hour monitoring of this health at mission critical locations, is an essential building block of customer satisfaction. It is also intuitive to think that real-time performance network monitoring can be coupled with a quality assurance program. In addition, using this data, work force automation can replace labor-intensive test procedures, troubleshooting procedures, and service restoral procedures.

It is important from a financial perspective because it drives subscriber satisfaction, subscription and ARPU ... in real time. For example, In Figure 1, at the conclusion of a service outage, a consumer is likely to make a disconnect decision in real time. Unlike cost versus benefit, this is an emotional decision. What the cable operator can do to drive consumer behavior is significant to the bottom line.

<b>Cheetah Network Tracker ROI Model</b>										
<b>Operations and Consumer Outcomes</b>	<b>Network Performance Monitoring and Quality Assurance Activities</b>									
	FCC compliance testing.	Monitoring high ARPU neighborhoods.	Detection of mechanical or structural damage	Pulse of the network.	24 hour monitoring problems	Analysis of network externalities	Technician in a box	Cheetah Professional Services	PoE (power over Ethernet) device	Contractor quality assurance
Management visibility into QoE and QoS "HEALTH"	Yes	Yes		Yes		Yes		Yes		Yes
Reduction of customer complaints		Yes	Yes		Yes					Yes
Higher ability to identify future outages		Yes	Yes	Yes						Yes
Visible tools to promote consumer goodwill		Yes			Yes			Yes	Yes	
Lower cost per technician work function	Yes		Yes		Yes	Yes	Yes			Yes
Reduced man-made after hours outages		Yes					Yes	Yes		Yes
Service problems proactively identified	Yes	Yes	Yes		Yes		Yes	Yes		Yes
Higher MTBF in network			Yes			Yes		Yes		Yes
ID of channel by channel problems	Yes				Yes					Yes
ID of audio problems	Yes				Yes					Yes
Resolution of high ARPU complaints sooner		Yes								
Resolution of high threat problems sooner		Yes								
Resolution of intermittent problems sooner					Yes					
More informed customer service		Yes			Yes					Yes
Consumer Goodwill		Yes			Yes			Yes		Yes

**Figure 4. ROI Model Outcomes**

In Figure 4, for each network performance monitoring and quality assurance solution, there is a notation of whether this impacts an operations or consumer outcome. For each operation, according to their own quality assurance and workforce automation programs, it is important to note they may in fact see this differently. Philosophical, situational, skill-level and infrastructure limitations may in fact result in a very different perspective. Regardless, the contention is with the deployment of network performance monitoring. Figure 4 represents all the possible benefits in each decision crosspoint. It is also important to make some broad observations:

1. The most significant outcome "impact" is in placing Network Trackers in high ARPU neighborhoods, in 24 hour monitoring of intermittent problems and in contractor quality assurance.
2. The midrange impact is in placing Network Trackers to achieve workforce automation including FCC 24 hour compliance testing, early detection of infrastructure problems (micro reflections and frequency response testing), and contracting Cheetah Professional Services to do after-hours monitoring/CheetahCheck one-time system analysis.
3. Although it does not impact as many outcomes, it is still believed that three monitors placed in the headend, longest fiber node, longest point in network can provide a system benchmark for all time.
4. Although it does not impact as many outcomes, it is also believed "technician in a box" provides a way for a technician to work with a dispatcher to eliminate a second technician (repeat service calls) or repetitive testing in a number of work functions.



## ***Conclusion***

Cheetah is in the business of developing systems management applications for the cable television operation, among other industries. The Network Tracker product family is our solution to allow for the integration of a total quality assurance program.

- ◆ Cheetah transponders providing network element testing, monitoring, alarming and reporting.
- ◆ Cheetah Network Trackers providing network performance monitoring and enabling quality assurance in HFC Broadband Networks.
- ◆ Cheetah breadth of partnership including Cisco/SA, Motorola, Arris, Harmonic, Alpha Technologies and many other key vendors to the cable television industry.
- ◆ Most importantly, rather than a simple hardware devices, Cheetah provides carrier class, purpose built systems management application software that embodies our understanding of quality assurance and operational efficiency.
- ◆ Cheetah professional services organization staffed with engineers, technicians and computer programmers that not only have years of experience on Cheetah systems, but the equivalent knowledge on all the network elements we subsume.

Cheetah Technologies believes that the Network Tracker (analog and hybrid digital HFC networks) and the Network Tracker Plus (digital HFC networks) represent a revolutionary step forward in network performance monitoring and in ultimate consumer satisfaction.