But it's my Network!

The pitfalls of sharing with others

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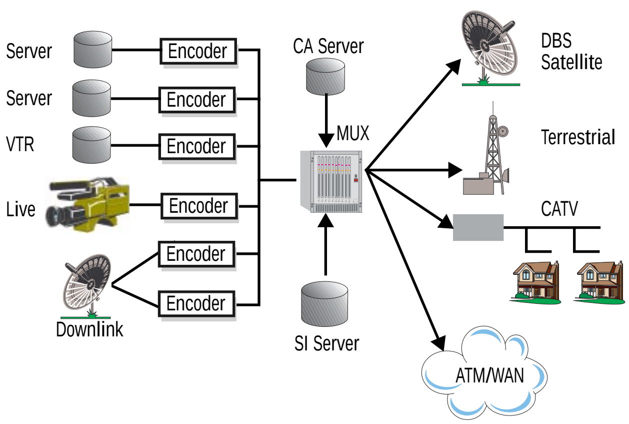
The advancement of networking and MPEG-2 digital compression technologies, combined with multi-stream data transmission enabled by packet switching, should allow operators to share networks between several services. While this sharing of networks should lead to higher efficiency and better service, there are risks involved.

With this as a new paradigm, we have limited collective engineering experience to draw from when problems happen. Maintaining broadcast integrity in the face of this complexity requires advanced monitoring tools and effective systems to insure quality, integrity and reliability of signals and content.

A strategy consisting of an effective monitoring solution that can identify problem areas and provide and deliver essential technical information to the right people in a timely and meaningful manner will ease this threat of the uncertainty that comes with advancement of network technologies.

Technology Advances

Advances in compression and the digital encoding of picture, audio, data and supplementary information has allowed content providers and broadcasters to offer a large number of innovative and profitable services. This advancement coupled with trends towards globalization give the opportunity to reach more people in wider areas. With these changes, there is the need to offer these services at a lower cost that requires fewer staff to maintain what's becoming a geographically far-flung network.



At the same time, broadcast networks have progressed from television to multi-service data networks – MPEG video, digital audio, data and metadata. Packet switching and multi-stream technology in television, and the emergence of MPEG-2 that allows video compression, are now widely used by TV broadcasters to distribute a multitude of channels with complicated content including multiple languages of audio, subtitles/closed captions, and embedded multimedia data. With this advancement, operators of transport networks – whether satellite, telecom, IP – have the opportunity to consolidate traffic of differing types onto a single, unified network.

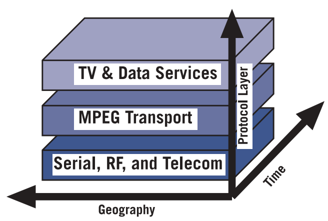
Theory vs. Reality

While in theory, this trend should lead to higher efficiency and better service, the complexity that comes with it has made knowing exactly what is going on in your network (and what to fix when it breaks) more difficult than ever. The modern signal path has totally changed from the days of a simple, straight line handmade network – often made with components from a single vendor – to a sophisticated interconnection of equipment closer resembling a computer or telecom network – coming from a many different vendors and assembled by a third party.

In turn, this evolution in broadcast technology has caused the dynamics of the television business itself to become more complex than ever. Maintenance challenges like signal impairments and errors that can accumulate along the way must be diagnosed and stopped before catastrophic failure can occur. Maintaining broadcast integrity in the face of this complexity requires immediate and real-time information to act upon.

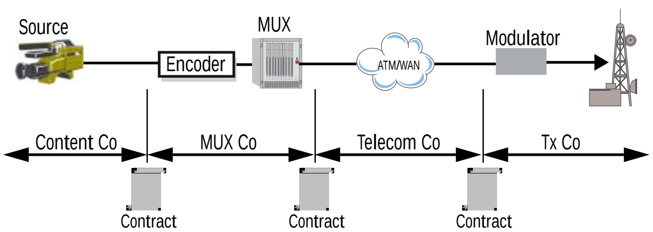
Using human eyes to visually inspect and validate picture quality is no longer possible or even feasible. Even if visual artifacts can be spotted, identifying where they're coming from isn't all that easy. Even if possible, today's problems go so much further than just picture quality defects.

Collecting and analyzing Quality of Service is the first step. However, simply ensuring that the signals are correctly sent does not guarantee that the programs are correctly delivered to the target audience. This is where validation for signal quality and content integrity is important. Finally, once a problem is detected, distributing alarm and fault information to those who need comes next.



Service Level Agreements (SLAs)

While sharing the network helps to reduce costs by maximizing bandwidth potential and minimizing wastage by allowing opportunistic data insertion, there are risks involved in terms of compromising signal integrity. Where opportunistic data insertion is allowed, there may be cases where data that needs to be transmitted exceeds the available bandwidth. This may cause a situation where information 'drops out of the pipe' when too much data is queued and cannot be transmitted. The risk of data loss due to insufficient headroom or poor bandwidth management is too big a price to pay for all parties in the video transmission chain.

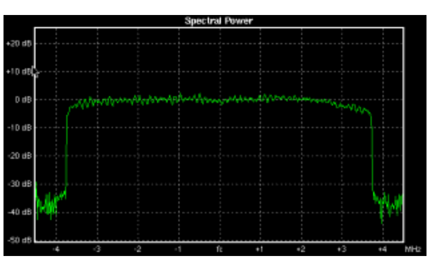


Clear performance metrics are important for setting the stage for Service Level Agreements (SLA) and the corresponding penalties for not delivering within these parameters. SLAs - a contract defining the terms of service as well as the recourse available to the customers should these terms not be met – is an important document that will help the parties involved avoid many otherwise possibly ambiguous parameters that may lead to unnecessary disputes.

Quality of Service Parameters

Defining the parameters and levels for Quality of Service create the common understanding; knowing exactly about the exceptions to those norms helps both the broadcaster and the transmission operator to either attack or defend their case respectively. Quality of Service generally encapsulates two factors: Signal Quality and Content Integrity.

Signal Quality is typically determined by physical factors like RF power, frequency, and bit rate error. It is affected primarily by environmental factors like terrain, equipment degradation, cabling, and coverage area. The probability of these influences happening will determine the uptime goal and error rate for a service to be provided.



Error
2001-20-19 01:09:58.232

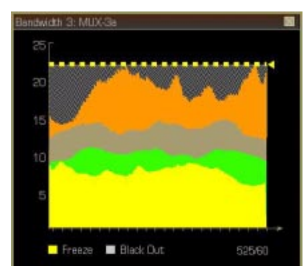
Port 4
SCV: Service [SPICE], CA "OFF" -- Should be "ON" !

Beyond that, in this emerging complex environment, broadcasters should be even more concerned about the moving of content from point-to-point and ensuring that the expected is delivered. Simply ensuring that signals are correctly sent does not guarantee that the intended programs will be delivered successfully to the intended target audience. Some program information profiles may be modified during the processes of encoding, multiplexing, decoding, re-encoding and re-multiplexing. As a result, service parameters such as the languages, audio or subtitles, may be incorrectly configured.

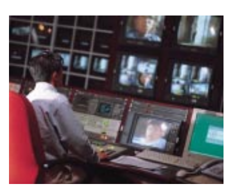
Advertising, being the main revenue source for broadcasters has created a recent hype for regional ad-insertion capabilities. It is a understandable concern for advertisers to want to ensure that not only did their advertisement run at the time it was supposed to, it was also broadcasted the way it was supposed to. Ad-insertion verification systems – part of content integrity – gives this confidence to advertisers, adding value to the service provided by media owners.

Although the Service Level Agreement sets the terms of service between the provider and the consumer and outlines the parameters within which the service is executed, the question then is how do you know if your standards have been violated? Where is the proof?

The Challenge



If each transport network were dedicated to a single purpose or user, that might be enough. However, transport networks are now mixing streaming data, Internet, and other information together with the television signals. Problems arising from the delicate inter-relationship between media types are the next management challenge: How do you find out if TV programs are affected by an increase in data traffic? And even if you do find out, whom do you blame?



To add to this challenge, broadcasters are being forced to monitor these new digital networks with fewer resources. With the trend towards remote lights out operations, it is not unusual for a single operator to be responsible for monitoring hundreds of channels and thousands of signal paths. This may include programs with sound tracks in various languages and subtitles.

Although we all know that it is essential for digital networks to move content from point-to-point in an accurate and timely manner, there is a risk for signal impairments and errors to accumulate along the way. This can eventually cause the network to fail, resulting in transmission failure.

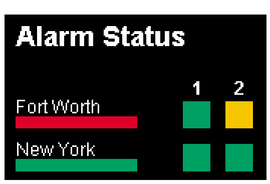
It is precisely the advantages of an all-digital transport infrastructure that will cause our next problems. With video compression now widely used to distribute multiple channels of valuable program content, advanced new monitoring tools are needed to insure network quality and reliability.

A comprehensive strategy of preventive monitoring is now essential to insure the integrity of not only the signal quality, but the validity of the program content. Preserving signal integrity throughout the stages of video transmission is essential in any effective monitoring strategy. There is a need for systems to monitor, manage and maintain this next generation network with many users, differing media and geographic distribution.

Preventive Monitoring

Effective monitoring of digital television networks requires the use of multiple real-time continuous and simultaneous evaluation checkpoints in the broadcast chain from studio to receiver. Those checkpoints must consider that both signal quality and service quality must be evaluated.

Given the complex structure of a modern program multiplex, identifying *normal* versus *abnormal* program content is hardly an easy task. To minimize system configuration and setup, it is essential the monitoring platform quickly memorize the broadcast as *nominal* or alternatively, receive baseline settings from an external traffic or automation system. Once running, any deviations within that desired multiplex structure should be immediate identified and flagged for action.



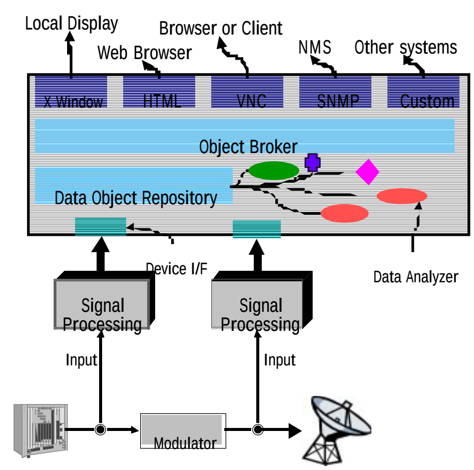
Mission critical, real-time monitoring information – in an easy to interpret form – must be available from remote locations. Simple “red light, green light” alerts are useful to non-technical staff, whose responsibilities may cover a myriad of different functions within the broadcast plant.

Once the problem is identified, it is important to distribute alarms and fault information to the respective people in a timely manner. Remote warning alerts of system instability should be made easily available over corporate LANs, the Internet, e-mail, pocket pagers and even text messages to mobile phones. Comprehensive logs should be generated in an order that maintenance engineers get a clear explanation of which system threshold deviated from the norm should a warning occur.

The DVStation Family

Pixelmetrix has focused on creating a single self-contained monitoring station that can analyze thousands of parameters within hundreds of digital television signals. Through the use of plug-in modules and parallel processing, we monitor all these parameters in real time, simultaneously and continuously. We’ve targeted our development efforts to insure the quality of the signal, the integrity of the program service and the delivery of essential technical information to the right people in a timely and meaningful manner.

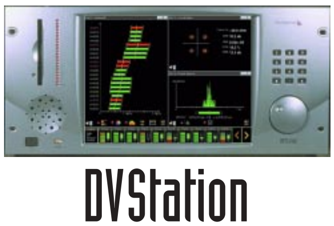
Our engineers began with a simple premise: Effective monitoring of digital television networks requires the use of real-time, continuous and simultaneous evaluation of hundreds of points along the transmission chain. To receive this necessary network intelligence, adequate data collection, analysis and correlation is needed on three axis – time, layer and geography. Monitoring of all layers – physical, transport, coding, and quality – is essential for a complete maintenance picture.



Plug-in modules allow flexibility and accommodate changes in a fast evolving technical infrastructure. So far, we’ve focused on three categories of plug-in modules: physical line interfaces (ASI, SPI, RF, ATM etc.); a transport stream processor (TSP); and picture quality processors.

The DVStation family is comprised of four product lines which scale based on the number of simultaneous inputs to be monitored. The flagship DVStation supports 21 ports within a single 5U mainframe. The smaller DVStation-Remote supports up to four ports, while the compact, book-sized DVStation-Pod is ideal for portable troubleshooting and installation. Finally, the DVStation-IP is a dedicated platform for those using a TCP/IP network (ethernet interface) for video transport.

DVStation



DVStation provides monitoring for RF, MPEG-2 transport stream, and content within an easy-to-use and integrated environment. Offering the highest port density in the industry, DVStation is ideal in environments with *many signals in one place* – such as satellite uplink centers, DTH operators, or cable head ends.

The design features plug in line interface modules which extract the MPEG-2 transport stream from the native RF or telecom signals and pass that data to a TSP – Transport Stream Processor. All modules provide monitoring capability on the physical layer. For RF interfaces (QPSK, QAM, COFDM, etc.) this provides an easy indication of overall modulation health. The 155 Mb/s ATM optical interface extracts an MPEG transport streams from several VP/VC's in addition to detecting physical layer errors and Sonet/SDH parameters.

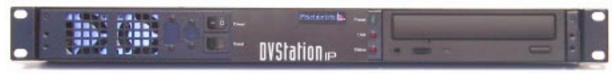
DVStation-Remote

Ideal for remote deployments with *a few signals in many places*, the DVStation-Remote consists of a 1U control unit and up to four interface adaptors. Remote diagnostics can be conducted simultaneously from several locations, or alternatively staff can access telemetry directly by attaching a standard keyboard and CRT.

Log files and recorded transport streams can be accessed remotely or downloaded for further analysis.

DVStation-IP

The recent explosive growth and significant technical advances in the Internet has provided broadcasters with a new alternative for program distribution. While IP backbone networks present the promise of the economical delivery of multiple media types bringing these networks on line still remains more of an art than a science.



The Pixelmetrix DVStation-IP, a world first of its kind provides advanced video and content analysis and monitoring functionality for IP networks. The compact 1RU form features a multi-speed 10, 100, and 1000 Mb/s interface (gigabit ethernet).

DVStation-Pod

Featuring the same software and user interface of the DVStation and DVStation-Remote, the DVStation-Pod product line consists of several book sized modules containing the interface circuitry. Each module connects to a laptop or desktop PC.

Light and portable, DVStation-Pod offers all the power and functionality of its bigger brothers in an extremely affordable package.

For More Information

To learn more about the DVStation, request a demo, or learn how Pixelmetrix might help your optimize video network integrity, contact us today!

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About the Author

Danny Wilson is president of Pixelmetrix Corporation, manufacturer of the DVStation, a preventative monitoring solution for digital broadcast networks. Mr. Wilson has 15 years previous experience with Hewlett-Packard where he was responsible for the introduction of the MPEGScope transport stream analyzer and the world's first ATM/B-ISDN test system which accelerated the development and deployment of ATM technology worldwide.