Tracking Content – The Power Of Media Biometrics

Snell Advanced Media

White Paper

One of the biggest practical challenges of multi-channel broadcasting is keeping track of all the content. It is clearly economically impractical to have eyeballs on every channel and variants through a major installation like a master control room or a playout center.

The accepted solution is to monitor by exception. Assume everything is working perfectly, and only sound the alarm if something is detected to be at fault. This is a sound principle, and one on which complex plants in other industries work.

The challenge with media is that the fault conditions are more subtle than a simple yes or no. Is it the right content? Is the video present but frozen? Is the audio present but silent? All these and many more are issues which need to be monitored, and which it is hard to do automatically.

These issues can be summarized under three broad headings:

- Is this the right content, or has something been routed incorrectly in the network
- Are the audio and video elements travelling along similar path lengths, or has their synchronization slipped
- Is there a change in quality?

While there have been technological solutions to this in the past, they have not been very successful, not least because they take a long time to register errors. Typically such systems can take as long as 90 seconds to lock up, by which time the complaints from viewers will already be flooding in.

There is a need for a new technology which can be used for automated content tracking – what we call **Media Assurance**. The core requirements might be summarized as:

- Both creating and detecting measurements in realtime
- Capable of accurately comparing and confirming content within seconds
- Independent of changes to resolution, framerate, and multiple encodings
- Non-destructive and invisible in operation
- Depending upon metadata which is very small, allowing it to be carried with the signal or over a separate network with effectively no increase in the payload
- Capable of meeting the three key requirements above and being extensible to other functionality as required.

This is the background to the decision by SAM to develop a new form of content fingerprinting to meet all of these challenges and aspirations.

Media Biometrics

Media Biometrics is the name given to a unique signature technology developed by SAM, and now implemented in a number of its products.

The underlying principle is that the algorithms look at the media file – video and audio – in both spatial and temporal planes, the way that a human would perceive it. The resulting signature, because it contains the essence of the picture and sound, is therefore impervious to format, frame rate, aspect ratio and color shift processing.

This is absolutely central to the Media Assurance system: Media Biometrics can match content after any of the processes which typically take place in a delivery system, for instance. An original signal may be up- or down-converted, passed through a color legalizer, and compressed for transmission, but Media Biometrics will still recognize it as the same content.

Media Biometrics is also sensitive to small motion in the picture. Earlier attempts at detecting frozen video using signatures failed on some content: a one-to-one news interview, for example, didn't always have enough motion for the system to detect.

Despite this, the amount of data associated with Media Biometrics is tiny. The payload is measured in bytes per frame. A new signature is generated for each video frame, and the data is continuously streamed.

For IP content the very small Media Biometrics stream can be handled over the same network, or across a business

network associated with the media.

Although many of its uses will be found in video systems, Media Biometrics is also applicable to radio. The audio and video footprints are self-contained, allowing it to detect lip-sync errors. The system works equally well without a video component for broadcasters who also want to use it to track the health of radio channels.

Architecture

Media Biometrics is not a standalone product or system. It is designed to be embedded into key points of the architecture.

There are two elements to the system. The first is the MBG, or Media Biometric Generator. This, as its name suggests, creates the signature. It can be embedded in anything that generates content.

The SAM Kahuna production switcher, for example, has MBGs on all 64 of its outputs. The Sirius 800 routers have MBGs on each input to the embedded multi-viewer. Other products, which create a significant new version of content, can have embedded MBGs. The output is the reference signature.

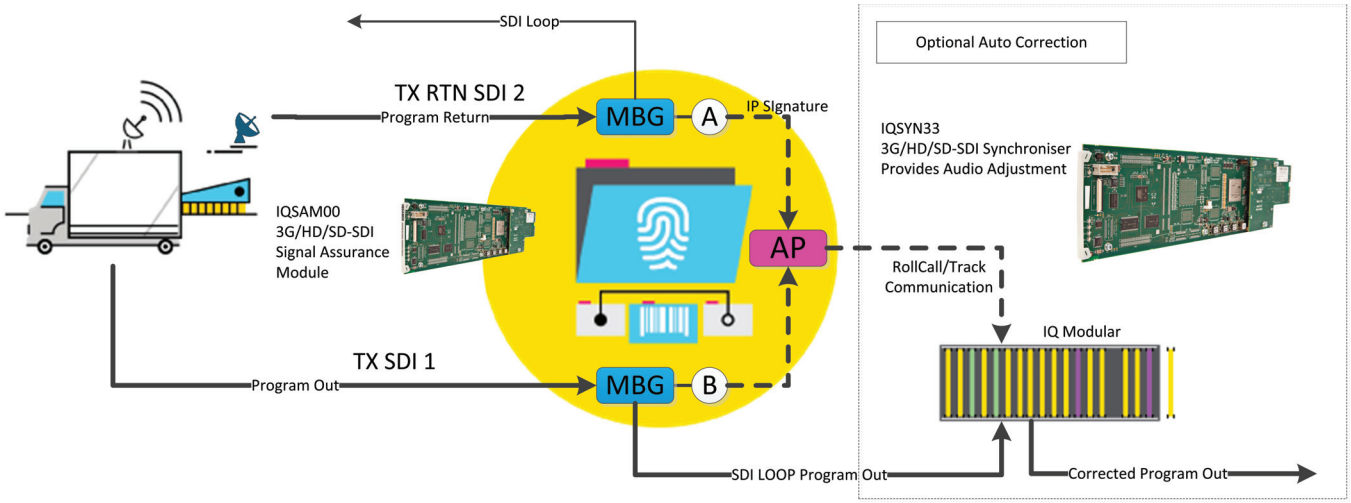
The second part of the system is the AP, the Assurance Point. An AP compares the new signature to the reference signature and determines if they are the same. Because of the power of the correlation algorithms built into Media Biometrics, an AP will lock up to the stream of data within two seconds (plus signature-sending network delay), generating accurate reporting from that time.

APs will be embedded in content-aware and schedule-aware processes, at critical points in the workflow. Signals may pass through many APs across the content chain. This gives an automated decision-making process which is very quick to respond and resilient to false triggers.

As well as being implemented in SAM products including iQ and iCE, APs can run as software on COTS (commercial off the shelf) hardware. A standard computer will support a large number of AP instances simultaneously.

Implementation

One way in which Media Biometrics can be used is within SAM's control and monitoring architecture. The RollCall system provides control and monitoring for the SAM product range, It also has a library of third party devices which can be monitored via SNMP, serial or GPI interfaces.



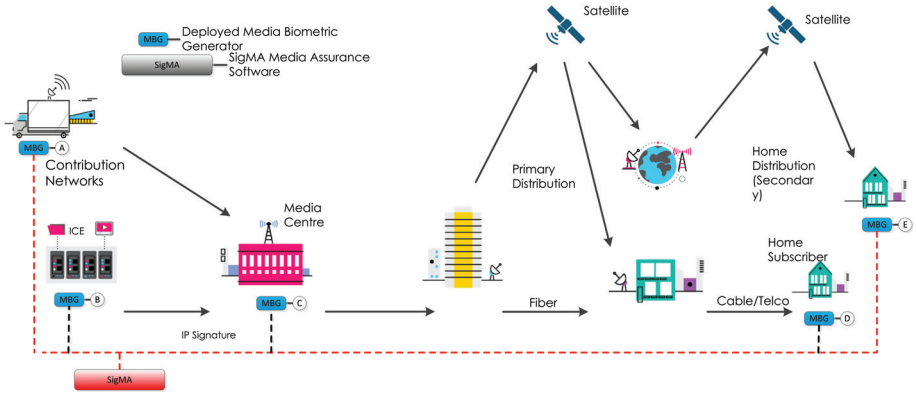
Media Biometrics deployed in a lip sync application for live production

The addition of an AP to a RollCall monitoring point allows the health of the content to be checked anywhere downstream. This means the system reacts within seconds to conditions including:

- Absence of video or audio
- Incorrect audio or video
- Lip sync errors
- Audio mapping errors – Media Biometrics currently supports 32 audio channels
- Video still or audio silence
- Media match confirmation that two signals are the same

Where RollCall is used in conjunction with RollMap, to provide a graphical representation of systems, then multiple APs can be used to track the source of a problem.

RollMap is designed to plot and monitor both local facilities and geographically-distributed operations. Media Biometrics fits into this environment, and can identify problems at any location equipped with an AP. It can be used to monitor off-air in a remote site, for example, to ensure that only scheduled content is transmitted.



Media Biometrics deployed as part of a network wide media assurance system

The above example system consists of the following components:

MBG A	1x IQSAM00 modular card within the OB environment, (1x AP, 2x MBG)
MBG B	ICE Integrated MBG, Playout, (8x MBG)
MBG C	1x IQMBG80 modular Card, Master Control Processing, (8x MBG)
MBG D & E	2x IQMBG80 modular Card, Return feed monitoring, (16x MBG)

The number and type of SigMA Assurance Point (AP) licences is determined by the level of monitoring required at each stage of the workflow.

In this case it is deemed sufficient to provide one standard SigMA licence and one Professional SigMA licence per channel. The Standard AP is used to monitor the signal integrity post IQ Modular processing and the Professional licence prior to transmission for media Match and lip sync errors.

Roadmap

As currently implemented, Media Biometrics delivers intelligent content checking, this provides a significant advance in systems monitoring, helping broadcasters build resilient delivery systems and get closer to the economic goal of lights-out playout.

The core technology is capable of considerable extension, and SAM has a roadmap for further applications. Some of these will add further to the technical quality assurance portfolio, and some will add new commercial capabilities.

Quality matching – with extensions to the core signature generation process, while still staying with a compact payload, it will be practical to develop a metric for signal degradation, based on PSNR (peak signal to noise ratio, the most common error metric to compare image compression quality). With multiple APs, it will be possible to identify any process responsible for significant quality loss.

Absolute delay – rather than the relative delay between audio and video which can be measured for lip sync errors, future enhancements will allow the measurement of the absolute delay across the signal paths. Any change in the delay will be an indicator of problems with hardware or routing, which may be a precursor to a complete failure.

Intelligent diagnostics – while an operator can identify the source of a problem through the use of multiple APs, in future this could be automated with the system simply reporting to the operator the area of failure.

Media identification – due to Media Biometrics' small payload size and powerful correlation algorithms it would be practical to create a complete library of signatures for checking content against. This would have applications in rights management for example.

Schedule-aware media identification – taking the same concept a step further, by integrating playlists from automation systems such as Morpheus, Media Biometrics can be used to check that the right content is being transmitted. Checking that the right commercials are transmitted is particularly important where advertising is localized and a single channel may have many sub-regions.

Conclusion

The attractions of getting a signature from a video stream and using it to check that we have the same stream further down the pipeline are obvious. It is an excellent way to improve quality and to reduce operational costs.

The inescapable fact is that all previous efforts in this field have failed. They take too long to match – 90 seconds is not uncommon – or they cannot cope with some content, or the data payload is too large.

Media Biometrics succeeds in these three areas. Correlation takes around two seconds. The core technology is agnostic to anything that is likely to happen to a signal in the delivery chain, from minimal movement to color correction, from aspect ratio conversion to logo insertion. Finally, the payload is remarkably tiny.

It is implemented as part of a system or network-wide control and monitoring system, providing a service-oriented approach to quality and supervision. It extends the capabilities of monitoring by exception. It is cost-effective, and proven.

Media Biometrics is an important step towards fully automated multi-channel, multi-platform delivery, a step change in the quest for lights out broadcast operations.