SOLUTION PAPER

Delivering Local Content Over IP Networks

VODxchange™ Content Creation System

The advent of time-shifted TV and Video On Demand (VOD) have increased user expectations for being able to view more content on their own schedules. Service providers representing different multi-channel programming delivery systems (satellite, telco, cable, internet) have all been expanding the availability and type of on-demand choices.

Of these, VOD offerings provide both choice and involvement to subscribers and represent a key service deliverable especially for competitive local exchange carriers (CLECs) and incumbent local exchange carriers (ILECs) in their attempt to field competitive service offerings.

VOD provides entertainment flexibility. Customers can select from a diverse library of digitally stored movies and shows, enabling them to control and watch entertainment on their own schedule. In addition to letting users watch what they want, when they want, the latest VOD services provide VCR-like controls to stop, pause, fast-reverse and fast-forward programs.

It is often said that "content is king" when it comes to home entertainment services and it is especially true for VOD offerings. National and mainstream content produced by Hollywood and others can be sourced either directly from studios or through intermediate content aggregators. The acquisition process for this content is already well defined, providing a myriad of licensing models for CLECs or ILECs to consider. While essential for any VOD service, this content can be dubbed as "me-too" content, i.e. everyone gets it. The cable MSOs, direct satellite broadcasters and large IPTV service providers, all have largely the same selection of hit movies, shows and sports footage.

Internet services have been the first to really expand the on-demand model by introducing User Generated Content – where non-professionally produced content can be made available to a wide range of viewers. For example, parents can capture a home video of the high school play and subsequently offer extended family a peek at their "star" performer. While the success and appeal of UGC is fairly well established, there may be a very attractive middle ground between professionally created content and home videos – that being locally captured community content.

Many communities already support locally produced content such as high school sports, city government proceedings, general interest programming hosted by local figures, as well as programs produced by students and independent artists.

A service provider could take their multi-channel service one step further by incorporating this local content within their VOD service. Local advertising spots interleaved with local on-demand content can also open up new revenue streams. Telcos, for example, can use on-demand to reflect the true local values of viewers and in so doing provide both a competitive advantage over much larger competitors who cannot compete on such a local level, as well as a catalyst for market penetration.

Challenges of Local Content

The fact that locally generated content comes in a variety of formats, resolutions and physical media has been one of its biggest barriers to its successful deployment over IPTV networks. For instance, a local producer may process its evening magazine show on a Mac platform and use the Apple QuickTime file format to edit and save the content. Similarly, producers who have made investments in MPEG-2 editing and encoding stations to support traditional broadcasters or local cable channels will continue to produce material in the MPEG-2 file formats. That material may further by enclosed in Material EXchange Format (MXF) files for interoperability reasons.

IPTV networks are generally being built using the MPEG-4 AVC standard. Also known as ITU-T H.264, MPEG-4.10, and MPEG-4 AVC, AVC is replacing MPEG-2 as a video compression standard. AVC takes advantage of the ubiquitous presence and massive investment in MPEG-2 broadcast infrastructure, preserving MPEG-2 as the transport protocol.

Leveraging this proven wrapper, AVC provides new compression methods that make full use of increases in computing power. The result is the ability to double, even triple, the carrying capacity of existing networks with minimal impact on previous infrastructure investments. The ability to move so much information through the existing telecommunications infrastructure is what has put the IPTV opportunity within reach of ILECs and CLECs.

What is needed is a simple and reliable way of ingesting multi-format files into the IPTV network so that MPEG-4 can be leveraged to enable rich and varied local content to be delivered to the local community that is demanding it. To achieve this, four main challenges must be addressed.

The first technical challenge in deploying local content on a MPEG-4 AVC based IPTV network is the ability to acquire local material that may come in analog, digital or various file formats and to transcode this material seamlessly into MPEG-4 AVC.

Second, the acquisition and transcoding operations need to occur in real time in order to minimize time-to-air of on-demand content and maximize competitive advantage. For example, the local high school football game can not only be carried "live", but also made available "on demand" *immediately after it ends* for the subscribers who missed parts or all of the game during the live broadcast.

Third, the resulting content that is encoded in MPEG-4 AVC must be of high visual quality and play out correctly on the set-tops that have been deployed in the field. This is particularly important as expectations of subscribers grow with the increase in the size and picture quality of TV sets available in the market.

Finally, if the service provider has a broadband offering in conjunction with their IPTV service, the VOD asset should be formatted for deployment on both networks in one step, rather than requiring separate encoding and processing steps for each one.

FIGURE 1: VODXCHANGE ADVANTAGES

Local Content Challenges	VODxchange Solution
Assortment of incoming physical media & formats	Ingests multi-format analog/ digital video & file content
Inconsistent visual quality between VOD & broadcast channels	Same MPEG-4 AVC encoding technology used in headend applications
Managing bit rates and bandwidth usage	Industry leading SD & HD visual quality at very low bit rates
Minimizing time-to-air for maximum competitive advantage	Single step transcoding in real-time at both SD & HD resolutions
Assurance of playback on target devices	Fully verified streams for set-tops, VOD servers and mobile devices

Turning Challenge into Opportunity

Motorola's VODxchange system is designed specifically to overcome these challenges and to ignite local content opportunities for CLECs and ILECs. VODxchange acquires and encodes multi-format video and file-based content to MPEG-4 AVC in real-time. It has a dual purpose design:

(a) Encoding and streaming of "live" SD and HD content for IPTV broadcast; and

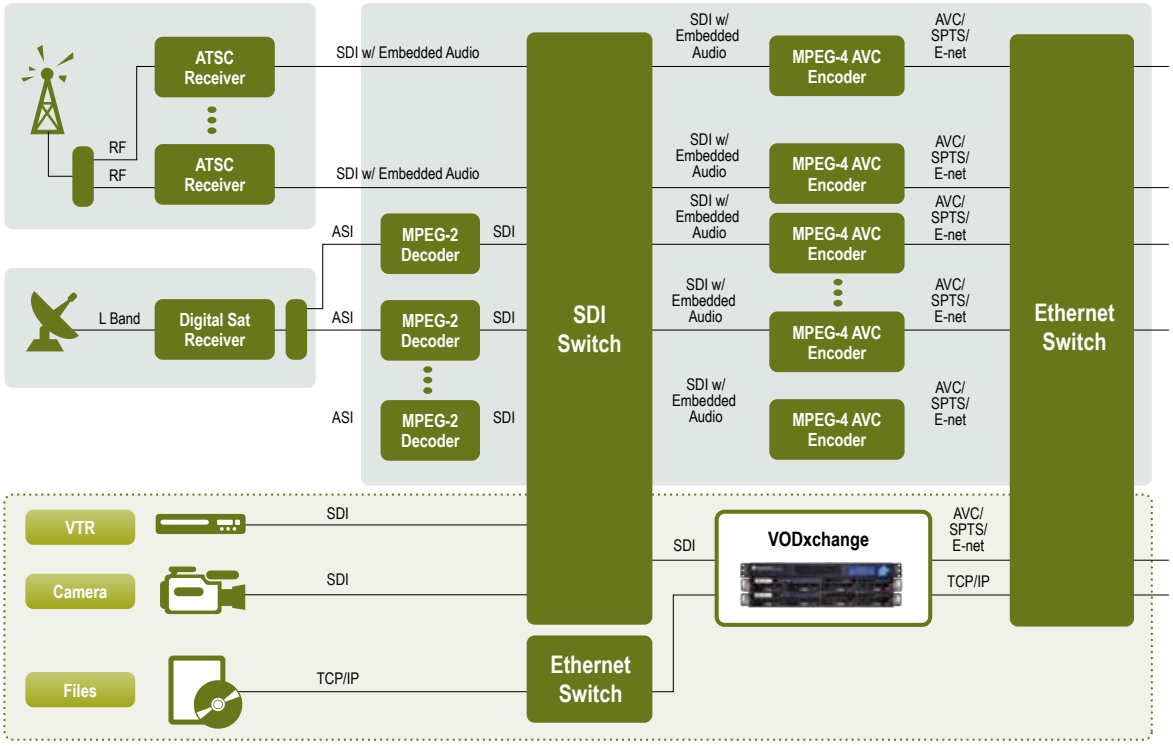
(b) Encoding of multi-format "file" based video content for IPTV VOD. VODxchange offers real time monitoring and quality control tools to ensure the highest visual quality ofthe output assets and it is capable of formatting the output assets for multiple networks.

Adding VODxchange to an IPTV Headend Infrastructure

VODxchange accepts digital and analog video inputs to ingest live programs as well as content from video tape recorders (VTRs), cameras, DVD players, etc. Additionally, it has multiple Gigabit Ethernet (GiGE) interfaces to accept file based content either via FTP or through network-mounted file systems. As shown in Figure 2, adding VODxchange to a headend infrastructure is just like adding any linear encoder.

Serial Digital Interface (SDI) feeds from off-air programming, VTRs and cameras can be easily routed to VODxchange through the same SDI video switch. The system can also be easily integrated with the site network infrastructure to accept file based assets from nonlinear editing systems (NLEs) or the site NAS/SAN for transcoding to MPEG-4 AVC.

FIGURE 2: NETWORK DIAGRAM



Putting VODxchange to Work

Live Program Encoding in Real-Time

A "live" SDI/analog feed can be ingested and encoded in real-time, as illustrated in Figure 3. VODxchange generates a UDP/IP MPEG-2 transport stream with MPEG-4 AVC essence over its GiGE port, as well as an MPEG-2 transport stream file on its internal RAID storage subsystem. The multicast UDP/IP stream can be handled by the IPTV network/middleware just like any other linear encoder in the headend.

The captured file can be copied off to a VOD server for near real-time network personal video recorder (NPVR) offering or to a NAS/SAN for archival purposes. With the inclusion of an external reference grade SD/HD decoder, the system can also provide real-time MPEG-4 AVC decoding of the IP stream to provide an SDI/HD-SDI signal for monitoring by the operator.

FIGURE 3: LIVE PROGRAM ENCODING

File-Based Encoding in Real-Time

Illustrated in Figure 4, the input file can have video and audio that is either uncompressed or compressed in any format, such as MPEG-2, DVCPro, QuickTime, WM9 etc. Typical locally produced content is sourced as MPEG-2 masters that are encoded at 30 or 50Mbits/s. VODxchange can read this file and encode it to an MPEG-2 transport stream (TS) file containing MPEG-4 AVC essence in real-time.

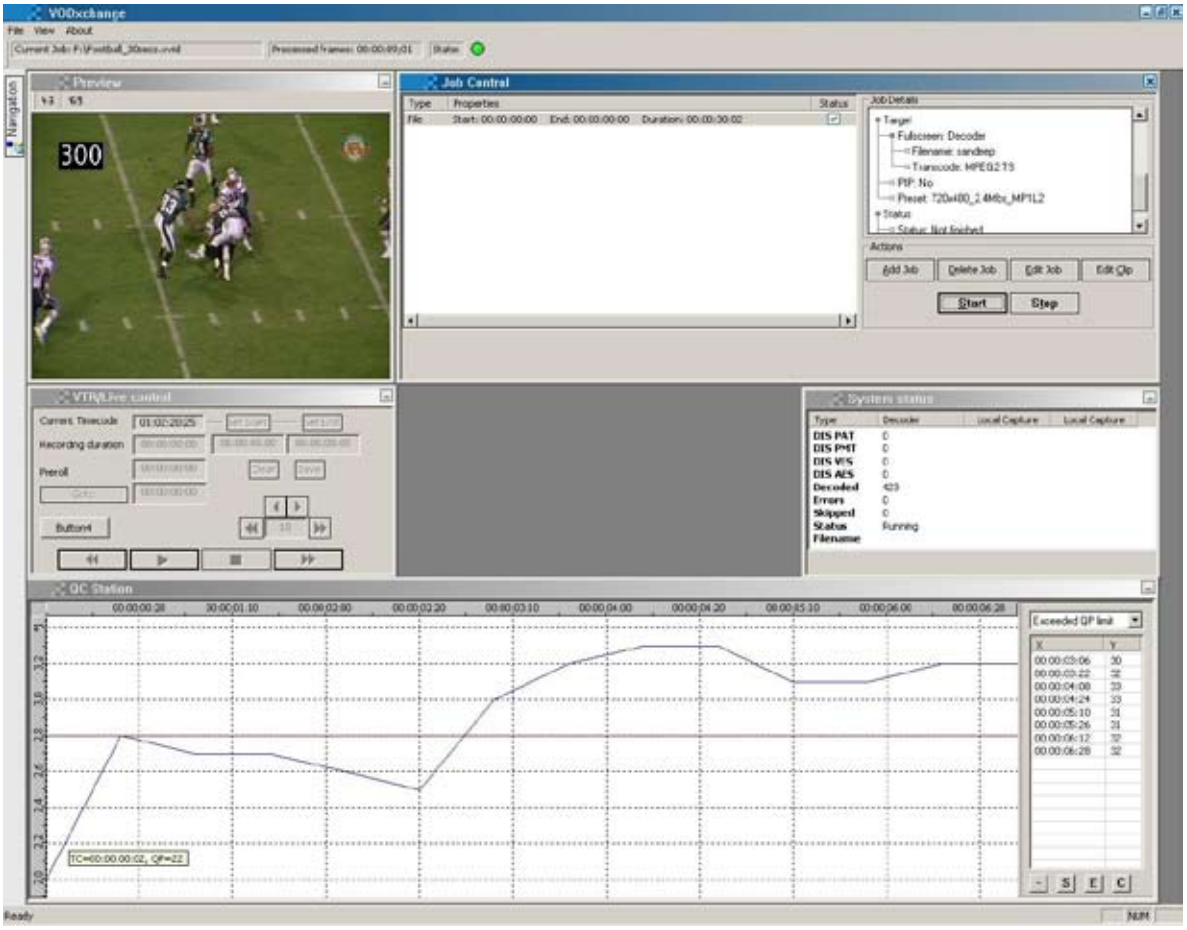
From the operator's standpoint, this occurs seamlessly in a single step. The system generates this MPEG-2 transport stream file on its internal RAID subsystem and additionally multicasts the transport stream over its Gigabit Ethernet port. With the inclusion of an external reference grade SD/HD decoder, the system can also output an SDI/HD-SDI signal for monitoring purposes.

Inserting a local station logo is also easily accomplished by simply specifying the location of the logo bitmap file and its screen coordinates through the system's user interface.

FIGURE 4: FILE-BASED ENCODING

Graphical User Interface

VODxchange is controlled through a GUI that is accessible locally or remotely over the network. The system can also be monitored via SNMP. The system supports both manual as well as automated encoding workflows to provide maximum flexibility and efficiency. The GUI provides all the necessary controls to manage both encoding modes and makes operating VODxchange extremely easy.



Conclusions

To enhance their IPTV strategy, service providers should expand beyond the traditional linear programming and VOD content available from Hollywood. As operators invest in building out large multi-channel video headends, they should consider allocating some of their capacity for local programming. The VODxchange system from Motorola is a complete solution for capturing and presenting compelling local VOD content that enables operators to harness locally produced content as a competitive differentiator.

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