# SATELLITE BROADCAST PRIMARY DISTRIBUTION TO HEADENDS

#### Introduction

Billions of people are watching precious TV content and advertising on a daily basis. Different distribution networks transport the content from the owner to the consumer. The consumer has the choice to receive a full set of TV channels from many service providers, be it telco, cable, terrestrial or Direct-to-Home (DTH) operators. Those service providers aggregate all information required to offer a full media experience to the consumer. This not only includes linear TV channels, but also increasingly important non-linear content, applications and metadata, creating a better user experience.

One important step in the content distribution network is the primary distribution of TV channels from the content provider's video headend and uplink (programmer video headend) to the headends of each of the service providers. In many cases, TV channels are distributed to hundreds or thousands of headends. Naturally, satellite is the preferred medium used for primary distribution.

Dispersed over vast geographical areas, these headends retransmit the received TV channels to many millions of consumers paying to watch the content. Any service loss in the primary distribution network instantly impacts millions of consumers, resulting in consumer churn and instant loss of advertisement revenues for service providers and content producers.

## DIALOG powered by Newtec *« iDirect*

A reliable primary distribution network is crucial. Any service loss instantly impacts millions of consumers.

ST Engineering

### **Content is King**

Content indeed drives pay-TV and advertising revenues. Hence the consumer demand for ever more content, consumed at a higher quality. Both the amount of TV channels and higher quality of those (HD and imminent Ultra HD), create the need to distribute more data over satellite. In many regions of the world, the required satellite capacity is not available, and if available, the capacity is sold very expensively along with long-term leases. In the recent past, many networks have upgraded from DVB-S to DVB-S2. The DVB-S2X standard results in yet another 15-30% efficiency gain in a typical distribution network. Combined with other advanced transmission technologies, such as Equalink 3<sup>®</sup> pre-distortion and DVB multistream operation, network optimizations can result in doubling the capacity at the same OPEX!

Content protection against theft (encryption), ad avail signalling transmission, and customer tiering and management are very important to protect revenues of all stake holders in the distribution chain. The transmission network needs to be able to transport the protection keys and additional metadata reliably, timely and transparently to the service providers' headends.



An increasing amount of TV channels, transmitted at higher quality, creates the need for a higher efficiency transmission. The DVB-S2X standard fuels growth in revenues and lower OPEX by up to 30%. Transparency in terms of video compression standards is not usually in place in today's networks. Very often, the receivers located in the service providers' headends only support one single compression format, namely MPEG-2 or H.264. The need for more efficient transmissions drives the evolution to new video compression standards continuously. However, any change in video compression standard requires a huge capital investment from the content providers, to upgrade all Integrated Receivers Decoders (IRDs) distributed in 100s or 1000s of headends globally.

While the industry is still in the process of upgrading networks to HD H.264, HEVC is already around the corner and will be required to distribute Ultra HD 4K content in a cost effective manner! The Newtec MCX7000 Multi-Carrier Satellite Gateway with its transmodulation capability gives the required decoupling between the satellite transmission and the video compression technologies.

Whilst in operation, the satellite link needs to be available at all times, protecting the operator's revenue streams. With respect to Service Level Agreements, reporting and documentation of actual operations are imperative.

Today's networks are generally uni-directional, meaning that **the content provider is blind to whether or not the content is well received and processed in the service provider's headend infrastructure!** On top of the uni-directional distribution of content and control of remote headend equipment, operators therefore see an increased need for a narrowband return channel with the remote headends to enable different monitoring applications, in-depth equipment control and even file transfers (non linear content, local ads, metadata).

Until today, such an infrastructure has been too expensive or operationally difficult using terrestrial (VPN) links. The solution set Newtec ST Engineering iDirect offers, lowers the barrier to entry on both CAPEX side and OPEX side.

Continuous (r)evolutions in video compression formats make a good case for deploying a satellite distribution network that is agnostic to the compression standard.

Cost-effective bi- directional monitoring over satellite creates visibility to the content owner of the local processing and adinsertion in all remote locations or a subset thereof (e.g. one per digital market).

## The primary distribution network needs to be transparent to

- Video and audio formats (SD, HD, Ultra HD, multi-channel audio)
- Video and audio compression standards (MPEG-2, H.264, HEVC)
- DVB and proprietary metadata and signalling information



## DIALOG® PLATFORM, M6100 AND MCX7000 ARE THE INDISPENSABLE TOOLS FOR A RELIABLE, EFFICIENT AND FUTURE PROOF TRANSMISSION SYSTEM

Newtec

Dialog

For traditional primary distribution, broadcast satellite M6100 Modulator and MCX7000 Multi-Carrier Satellite Gateway provide the level of uptime and the necessary **performance and features** to satisfy the most demanding operator. **Satellite transponder efficiency** is guaranteed by the DVB-S2X standard, reducing OPEX up to 30% in such distribution networks.

For operators in need of an interactive communication channel to remote locations, the **Newtec Dialog** platform provides a solution that is truly flexible in adapting the platform to advanced monitoring capabilities, facilitating linear and non-linear broadcast workflows,

enabling multiple broadcast, telephony, file exchange and data services. **Newtec Dialog** is a real multi-service platform. At the same time, its built-in scalability features allow the system to be sized exactly to the customer's needs, ensuring an optimal CAPEX.

Last but not least, the ST Engineering iDirect solutions are **tested by major video headend solutions providers** including Arris, Cisco, Ericsson and Harmonic amongst others.



Newtec's M6100 Broadcast Satellite Modulator and MCX7000 Multi-Carrier Satellite Gateway

### **Primary Distribution Satellite Link Improvements for Existing Networks**

Legacy satellite broadcast primary distribution is using DVB-S and DVB-S2 modulation. With the M6100 Broadcast Satellite Modulator in the uplink station, satellite link efficiency can be improved by enabling ST Engineering iDirect technologies, such as Clean Channel Technology® and Equalink® 3 pre-distortion, which are both available as a software license key. Clean Channel Technology allows for reduced roll-offs as small as 5%. Through advanced filtering technology, the carrier spacing can be reduced to up to 1,05 times the symbol rates, resulting in an immediate bandwidth gain of up to 15%. Professional IRDs on the market support smaller than 20% roll-offs.

Equalink® 3 predistortion has been fully automated. It can lead to up to 10% bandwidth efficiency gain in a single carrier per transponder set-up, while pre-serving interoperability with any DVB-S/S2 receiver, IRD (and set top box).

In practice, customers can use this efficiency to add more video channels to a transponder at the same cost, add more HD channels, grow their geographical footprint and increase service availability.

A further benefit is that the M6100 can be configured to inject a Carrier Identifier (DVB-CID), helping to reduce the impact of RF interferences on the satellite.

The M6100 interoperates with all market leading video headend systems and is transparent for encryption systems and video compression formats. To simplify installation, the M6100 supports ASI as well as Gigabit Ethernet Interfaces for hooking up IP based encoders or multiplexers. Data can be transmitted from the uplink to the IRDs (e.g. software or configuration updates, private data) using the built-in MPE transport capability of the M6100. This MPE inserter is very efficient, replacing NULL packets in the video stream with valid data packets (opportunistic data insertion).



Figure 2: Broadcast primary distribution to headends

Enabling the higher efficient transmission only requires the matching software licenses on the M6100 in the uplink. No changes in the installed base of IRDs is required.

## Highly Efficient Primary Distribution enabling more SD and HD content. Be prepared for Ultra HD

Additional efficiencies in transmission can be achieved by further optimizing transmission technologies. By deploying a dedicated MCX7000 Multi-Carrier Satellite Gateway in the remote sites, to act as a single frontend to the installed base of IRDs, the operator can enable a lot of new transmission technologies, such as DVB-S2X, Multistream and Wideband up to 72 MBaud.

Combinations of one or more technologies can result in additional throughput of over 100% - using the more efficient DVB-S2X, Equalink® 3 pre-distortion in the uplink, and saturating the transponder with a single multi-stream and 72 MBaud carrier. As a result, the operator can either distribute more and higher quality programs in the same bandwidth, or save OPEX by reducing the leased satellite capacity.

Supporting higher transmission efficiency enables cost- effective HD, or 4K (UHDTV) transmissions, without compromising on availability and reliability. These gains, which can be up to 37% for 64APSK can be realized through use of DVB-S2X.

DVB-S2X is a open standard which allows for interoperability and avoids vendor lock-in.



Figure 3: Broadcast primary distribution to headends



#### 10 Improvements in DVB-S2X

- Smaller roll-offs
- Advanced filtering of satellite carriers
- Increased granularity in MODCODs
- Higher order modulation: 64/128/256 APSK support
- Linear and non-linear MODCODs
- Better implementation of MODCODs
- Wideband support
- Very low SNR support for mobile applications
- Channel bonding
- Additional standard scrambling sequences to mitigate co-channel-interference (CCI)

Bonding multiple carriers together into one big virtual carrier, increases the efficiency gains of the video statistical multiplexed by up to 20%. This will ultimately be a key technology to distribute statistical multiplexed Ultra HD streams containing ten or more TV channels in one transport stream of 160-220 Mbps.

**Multistream** (DVB MIS) capability allows operators to aggregate a number of independent transport streams or IP streams into one carrier in a fully transparent manner, maintaining the integrity of the original content.

**Wideband** transmission provides these aggregated streams to be up to 72 MBaud, resulting in one large single carrier to be transmitted over satellite. This allows the operator to saturate the transponder, thereby increasing the efficiency with up to 20% through non-linear operation.



## DO YOU KNOW THAT YOU CAN BENEFIT FROM HIGHER TRANSMISSION EFFICIENCY WHILE PRESERVING YOUR INSTALLED BASE OF IRDS?

The upgrade of a network from DVB-S to DVB-S2 or DVB-S2X is generally perceived to be very expensive. Indeed, the installed base of IRDs represents a high CAPEX because the IRDs contain multiple functions in one box:

- L-band satellite reception inputs (DVB-S and/or DVB-S2)
- optional GbE and ASI inputs
- transport stream decryption
- in-band controls
- video/audio decoding and transcoding (MPEG-2 and/or H.264)
- metadata processing (e.g. cue tones)

Combining all those functions together in a single box makes the transition to new

The MCX7000 Multi-Carrier Satellite Gateway is ideally suited to benefit from a higher efficient transmission in existing networks, or to prepare the network for future upgrades to new video standards. Operators can benefit instantly from higher efficient transmission, while preserving the investment for future upgrades to HEVC and Ultra HD. technologies and standards difficult. In practice, network upgrades are done late in time, at the point where multiple new technologies converge together. As an example, large network upgrades have been triggered by a combined upgrade to High Definition + H.264 + DVB-S2. The business case to roll out new and upgrade existing networks (IRDs) to these new technologies, made sense by combining the benefits of all 3 new technologies together into one investment round. This is of course the result of the fact that IRDs combine all three functions together in a single box.

The alternative that exists, is to split the different functions in multiple boxes. Depending on the number of channels received per headend, which is ever increasing – it makes economic sense to upgrade the satellite transmission network to a higher efficient transmission using DVB-S2X, while

upgrading to HEVC and possibly Ultra HD can be done at a later stage. In this way, distribution networks can instantly benefit from a higher efficient transmission, opening the door to either

using less transponder space

#### distributing more channels without buying more satellite capacity

The MCX7000 Multi-Carrier Satellite Gateway ideally fits as a satellite front-end feeding multiple IRDs. The MCX7000 receives multiple MPEG-2 transport streams from a single or multiple saturated transponder(s) using DVB-S2X. It then extracts those transport streams and feeds them over ASI or IP into the existing installed base of IRDs. One MCX7000 can be used for tens of TV channels. In case older IRDs have no ASI nor IP input, the MCX7000 can even transmodulate the DVB-S2X multistream carrier into a traditional DVB-S/DVB-S2 singlestream carrier!





# DO YOU KNOW THAT THE HIGHER MODCOD GRANULARITY ALLOWS YOU TO MATCH THE SATELLITE FOOTPRINT OPTIMAL TO THE GEOGRAPHIC REGION?

Assume the following example:

We want to cover the purple region with a satellite distribution system. The satellite EIRP is depicted on the map and is determined by the transmission efficiency, service availability and size of the satellite terminal.





Using **DVB-S2 20%** roll-off, 8PSK 3/4 is the best match to achieve a defined availability with a certain terminal size. The higher modulation 8PSK 5/6 cannot be used since the full geographic region is not covered.

Using DVB-S2X with a higher MODCOD granularity, allows the selection of 8PSK 13/18 modulation to much better match the target footprint. This MODCOD results in 16% bitrate gains compared to DVB-S2, without compromising service availability!

Alternatively, customers can opt to achieve the same bitrate from DVB-S2X as DVB-S2, while benefitting from smaller dish sizes!



### **Interactive File Multicasting and Unicasting**

In order to meet SLAs, primary distribution operators become more and more interested in monitoring capabilities of the remote locations in addition to being able to control them. Reporting capabilities of revenue generating events is very important, such as actual broadcasting reports of ad insertions or even full broadcast confidence monitoring per region.

#### THE BI-DIRECTIONAL VSAT SATELLITE LINK

Low bitrate transmissions such as monitoring and control, and VoIP services are usually based on VSAT MF-TDMA

access technology. This always-on connectivity provided by the Newtec Dialog platform supports a mix of always-on broadband and VoIP connectivity on a 4CPM MF-TDMA return link between the remote terminals and the central playout, guaranteeing the QoS of each of these services through per service QoS settings.

## The narrowband link requires a very low amount of satellite capacity consumption, while the cost of the terminal is very affordable starting at just a few hundred dollars!



Figure 5: Broadcast interactive primary distribution to headends

BENEFITS OF NEWTEC'S ST ENGINEERING IDIRECT'S TECHNOLOGIES FOR BROADCAST INTERACTIVE PRIMARY DISTRIBUTION

#### FLEXIBILITY

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- Breadth of choice for satellite RF interfaces as well as audio/video interfaces
- Agnostic to video compression technology (MPEG-2, H.264, HEVC)
- Agnostic to video format (SD, HD, Ultra HD ready)
- Supports video, audio and data distribution and exchange
- Integrated with all leading manufacturers of video headends and distribution systems (Cisco, Arris, Harmonic, Ericsson, etc..)

### **Interactive File Multicasting and Unicasting**

Assuming bi-directional connectivity is in place, the same Newtec Dialog platform can be used to facilitate file multicasting from the central playout to the headends and file unicasting from the headends back to the central playout. This opens up the classical video live distribution network for new technologies such as distribution of files for VoD, ads, video clips, etc. The return channel can be used for backhauling video files from regional headends.

The Newtec's File Exchange module provides the operator with a tool to transfer file based content error-free and is conceived as a software product that can support various use cases typically found within satellite broadcasting, serving a broad range of point-to-point and point-to-multipoint applications.

The File Exchange module is designed for satellite optimized file transmissions, supporting file transmissions over a unidirectional

link with guaranteed file delivery through FEC mechanisms and retransmission of lost file fragments.

The Newtec Dialog platform can provide a very cost effective solution with MDM2510 Modem and MDM3310 Modem. These modems provide 4CPM and HRC modulations used in a MF-TDMA or Mx-DMA<sup>™</sup> access mode for always-on connectivity.

Newtec Mx-DMA is the return technology that incorporates the best features of MF-TDMA and SCPC technologies, solving the difficult choice of selecting one or the other. MF-TDMA is ideally suited to provide broadband access for monitoring and control to large populations of remote headends. Mx-DMA is ideally suited to provide larger bandwidth from the remote headends towards the broadcast uplink enabling, for example, file transfers.



Figure 6: Broadcast interactive primary distribution to headends

#### EFFICIENCY

- Turn a traditional distribution network into a •
  more efficient interactive distribution
  network while preserving installed base of •
  infrastructure
- Re-use existing IRDs in all growth scenario's,
  including NMS and encryption:
- no operational changes

**SCALABILITY** 

Add file distribution and exchange to traditional live distribution

- Use highest modulation efficiency including SW upgrade to DVB-S2X
- Clean Channel Technology works with a lot of professional receivers up to 10% roll-off
- Full transponder saturation with DVB multistream
- Efficient transponder utilization using linear and non-linear Equalink<sup>®</sup> 3
- High performing and patented demodulator : better link margin and RFI resilience compared to silicon based IRDs
- Fast troubleshooting of video headend using real-time transport stream analyzer in all modulators