Enabling a True Connected TV World

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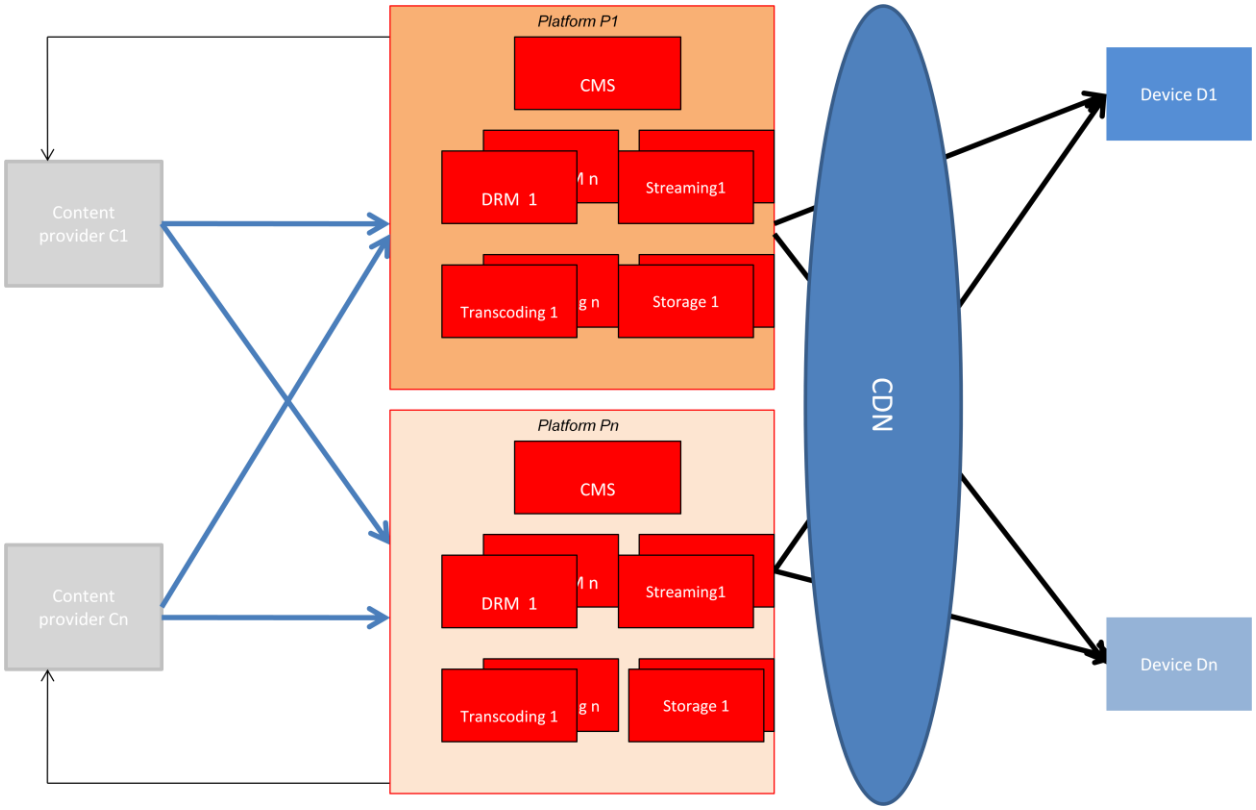
Abstract :
This paper explains how the new MPEG DASH specification can be used to offer a technology that, combined with the HbbTV standard, can connect any service to any connected device in the future.

Introduction
The market for connected TV is currently fragmented. In the U.S. we see a few very popular dominant applications, such as YouTube, Netflix and Hulu, ported by all major TV manufacturers to their respective platforms. In Europe, the TV set manufacturers are offering applications for online VOD sites. As in the U.S., each content provider needs to port its application to each connected TV set platform. This is very unwieldy for both content providers and for TV manufacturers, not only in terms of development but also in supporting the evolution of these services and platforms.

Adding to the problem, today each TV manufacturer selects an individual set of protocols and DRM, which forces content or service providers to encode, encrypt, store and deliver in several formats. This creates a higher cost of ownership as content needs to be encoded, encrypted, stored and delivered in as many combinations as there are platforms deployed. This then creates consumer confusion, as there is no guarantee the connected TV will be able to connect to whatever service the consumer would like to reach—including services that work just fine on the consumer's PC.
Figure 1 illustrates the current architecture of OTT delivery system.



Each content provider (C1..n) distributes to a specific platform (P1..n) . Each platform is made of several key elements:

- Transcoding for live and file-based content (**Transcoding**) which needs to transcode to each different format supported by the devices (D1…n).
- Content encryption and DRM (**DRM**), which needs to protect the content according to every protocol being used.
- Streaming (**Streaming**), which must be done across all the possible protocols
- Storage for the VoD and catchup files (**Storage**), which must be duplicated to all the different formats being sent to the devices.
- **Devices** (D1…n) which can process only certain formats. These formats are a combination of codec, encapsulation, streaming protocol and DRM.

As there are no interoperable standards, each device has a specific DRM system and supports a specific encoding profile (codec, bit-rate ranges, adaptive streaming protocol). Therefore a specific encoding/fragmentation/encryption/DRM combination needs to be applied for each device type, stored in the headend, streamed in a particular format and transferred to the CDN. This increases the complexity as well as the cost of delivering the content.

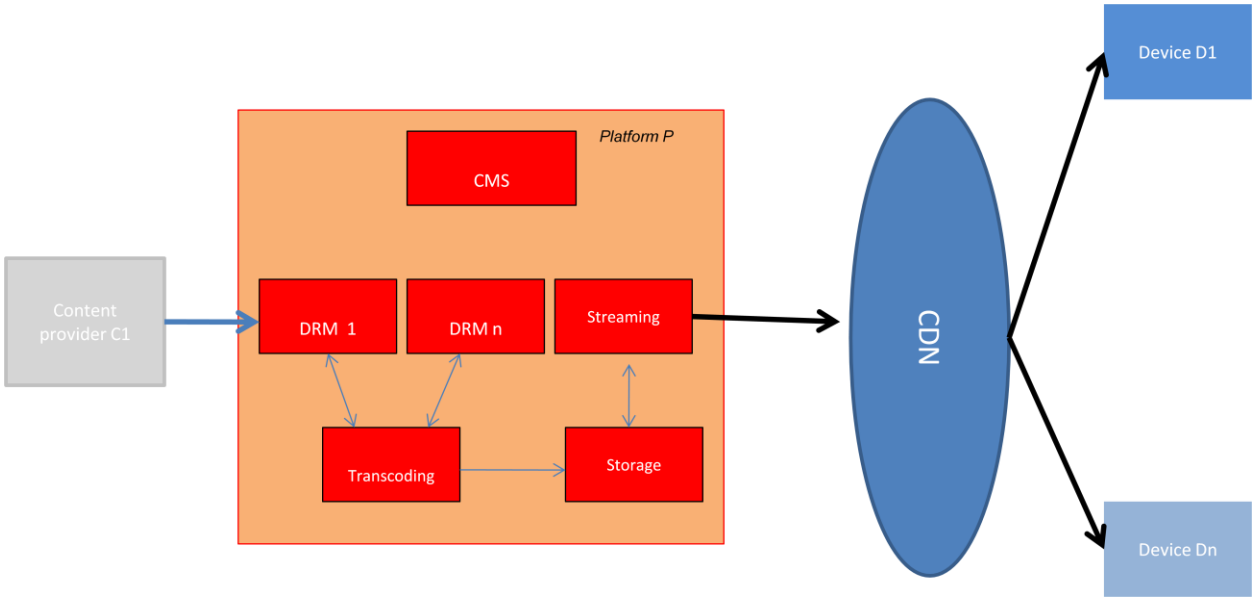
<u>Solution based on MPEG DASH and Simulcrypt DRM</u>

The newly released MPEG DASH standard [1] offers a playlist mechanism that supports either fragmented TS format (derived from an Apple specification) or MPEG-4 format (derived from the

Microsoft Smooth Streaming specification). Inside each of those formats it is possible to have a common encryption scheme that will allow content to be encoded and encrypted once with a single master key that can be used by several DRM servers and clients. The main benefit is that a content/service provider can address a wide variety of DRM specifications within one defined format (TS or MPEG-4), increasing device support..

In parallel to that initiative is HbbTV [2], which has already defined interactivity specifications on connected TVs in its 1.1 version. HbbTV is standardizing the use of multiple DRM systems based on the Open IPTV Forum specification [3], which itself refers to MPEG DASH. When an HbbTV-standardized HTTP protocol is used, the video and interactive portions of the same content can be played on any TV. One important point is that any IP device with a built-in HbbTV player will also have the ability to decode the signal. This will be the first time a single feed can be played on a TV, tablet, PC, connected Blu-ray player, game console or smartphone using the same video stream, the same control flow, and different DRM systems.

The MPEG DASH solution is illustrated in Figure 2.



This figures shows the workflow from one content provider to multiple devices.

The content provider distributes to a specific platform. The MPEG DASH platform is comprised of several key elements :

- Transcoding for live and file-based content (**Transcoding**) that transcodes in H.264 format for all the different required profiles. Note that as there are two different encapsulation formats, a dual encapsulation is needed in case both TS and MPEG-4 formats are required.
- Content encryption and DRM (**DRM**) will encrypt the TS and MPEG-4 files with one single key. The DRM server will add metadata related to content rights on top of the encrypted file.

- The streaming (**Streaming**) will only have to be in two formats: fragmented MPEG-4 or fragmented TS, using the unified DASH playlist mechanism.
- Storage for the VOD and catchup files (**Storage** is at maximum in two different formats.

Deploying an MPEG DASH solution

In practice, we expect content and service providers to deploy only one protocol type: either MPEG-4 or TS. France has already decided that both Marlin and PlayReady DRM will be used with fragmented MPEG-4 and a recommendation as been madefor HbbTV 1.5 in that respect.

Using one protocol between MPEG-4 and TS has several benefits:

- It limits encapsulation to one format
- It limits the storage to one format
- It limits the streaming to one format
- It limits the CDN traffic to one format.

In this scenario, the single format MPEG DASH implementation is the most optimal in term of cost.

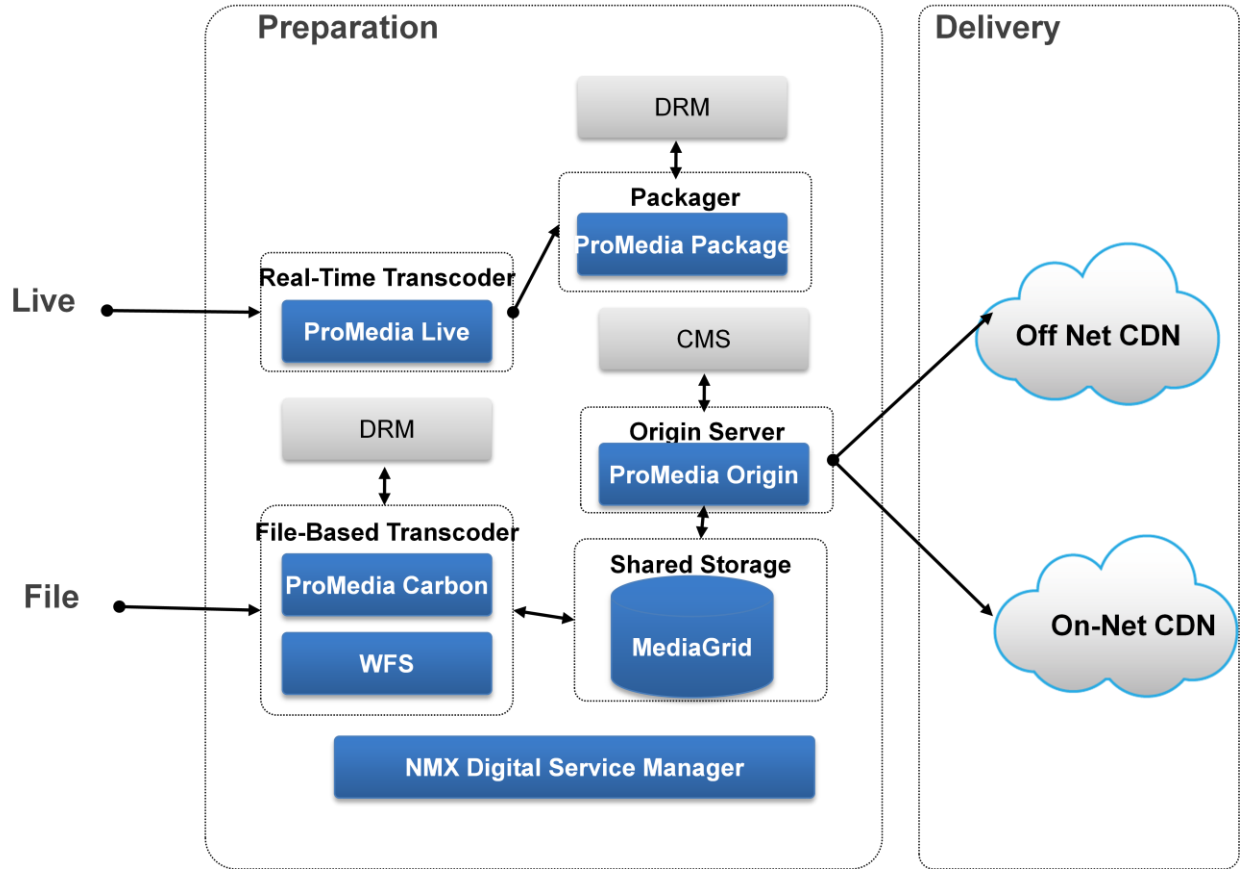
This may not address all market needs considering that Apple has a very large installed base of fragmented TS-capable iOS devices and that Microsoft has a very large installed base of fragmented MPEG-4 with Smooth Streaming. In that case, two different formats may need to be generated on the headend side. Some of the storage could be optimized by having in the clear storage and encapsulation on the fly, but this will be a tradeoff between processing power and storage. The CDN traffic will have to be doubled, however, as content will most likely be protected in an Internet delivery scenario. In a typical MSO/telco “On Net” scenario, however, one can consider edge encapsulation encryption, with storage in a common format, transmission over the IP network in the clear and encapsulation/encryption at the edge.

Harmonic Contributions

Harmonic has deployed a large number of adaptive streaming solutions based on Microsoft smooth streaming and Apple HTTP Live Streaming. It recently announced a new family of software products , the ProMedia family, that provide the key functionalities for :

- Transcoding for live with **ProMedia Live** and file with **ProMedia Carbon**
- Content encryption and encapsulation with **ProMedia Package** that will interface with DRM servers
- Streaming with **ProMedia origin**.
- Storage for the VOD and catchup files with **MediaGrid**

This architecture will, with a software upgrade, be capable of supporting MPEG DASH protocols and therefore supporting a Simulcrypt DRM architecture. Harmonic is working with several partners on the DRM side such as Intertrust and Microsoft (IIS-7 and PlayReady) to demonstrate an MPEG DASH DRM simulcrypt solution based on existing products in 2011, in order to deploy commercial products in 2012 as soon as connected TV is ready on the client side.



Conclusion

Connected TV is on the verge of commercial viability at last.Using SimulCrypt DRM, the MPEG DASH and HbbTV initiatives will enable an interoperable TV ecosystem, and open the door for content and service providers to launch unified TV Everywhere services.

References

[1] : ISO/IEC 23001-6 Information technology – MPEG systems technologies – Part 6 Dynamic adaptive streaming over HTPP (DASH)

[2] : ETSI TS 102 796 1.1.1 Hybrid Broadcast Broadband TV

[3] : OIPF Release 2 Specification