

The role of digital watermarking in enabling an early-release HD movie window for VOD and Broadcast – **The VOD Server Integration**

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Executive Summary

Early-release HD movies represent a significant revenue opportunity for the PayTV and hospitality industries. Consumers will welcome a new VOD release window but content owners need assurance that new piracy attacks, such as camcorder recordings, can be deterred. Digital watermarking provides the solution by making it possible to identify the exact source of illegal copying.

This Civolution White Paper outlines the business opportunity for early release movies in high-definition and explains why the Return on Investment figures for digital watermarking are so compelling. It explains how watermarking works and why it can be implemented cost-effectively without disrupting existing network technologies.

The paper is specifically looking into VOD server integration watermarking implementations. It argues that digital watermarking is a consumer-friendly approach to content protection and explains how industry stakeholders can work together to counter criminal-level attacks. It concludes with a look at how content owners can now deploy watermarking techniques to protect and monetize content throughout the release window lifecycle and however it is distributed.

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The market for early-release HD content

As more consumers enjoy HDTV, digital cinema and Blu-ray DVD, the hospitality market is keen to maintain its position as a premium entertainment provider by introducing early release movies in high-definition. Meanwhile, the PayTV industry also recognizes early-release HD as a promising source of new income. Having already invested in high-definition and Video on Demand (VOD) infrastructure, platform operators can expect high returns from this type of content with minimal additional investment. In fact, early-release HD represents one of the best business opportunities in both these markets during the next few years.

The concept of early release is already proven in the hospitality market, where hotel visitors are used to seeing content quickly after cinema release and before DVD (albeit in standard definition). There is also a home market for early release content that is not being served today. Families or busy people with little leisure time are among those who would pay a premium VOD rate to see new movies at home before DVD release. The proliferation of HDTV subscriptions, widescreen TVs and home theatre systems means this market is likely to grow.

Deterring camcorder attacks

The content industry is reviewing its traditional release windows but has been reluctant to grant early access to HD content because of the threat of piracy. There is a clear danger that 'pirates' could exploit the high quality HD signals and displays in a hotel room or consumer home to record and then illegally copy and distribute content. This is achieved by exploiting the 'analogue hole' that exists after the point of signal decode and decryption, when an analogue signal is sent to the screen.

Recording from a television screen, HD camcorders provide sufficient quality to make bootleg recordings valuable. The PayTV and hospitality industries must convince content owners that they can minimize the risk of camcorder attack. Conditional Access and Digital Rights Management alone are not enough to prevent copying as they are designed to protect against signal theft rather than content theft. So the solution is digital watermarking, which works alongside encryption and provides a new layer of protection.

Watermarking introduces unique identifiers into video content that are imperceptible to the human eye, which cannot be removed and which can be used to trace the illegal copy back to its source. The technology is already proven in the pre-release market where it has been used for many years to deter unauthorized copying from screeners and post-production content.

Civolution’s video watermarking technology has helped identify the source of illegal copies of the Academy Award screeners, for example, and is used to prevent them being copied.

The content industry knows and trusts digital watermarking technology. It is unlikely that major studios will allow early-release HD without this additional protection.

Working alongside existing technologies

The good news for PayTV operators is that introducing digital watermarking is painless and cost-effective. Watermarking does not disrupt existing network technologies. It is complementary to CA/DRM and does not interfere with an existing content security system.

Watermarking uses very different techniques to those used in CA/DRM. It is not designed to replace CA or DRM. Because the technologies are complementary there is a natural opportunity for Conditional Access and watermarking vendors to work together to enable fast deployment of this technology at the lowest cost possible.

Watermarking technology is mature and is available via software integration with leading silicon solutions for set-top boxes and integrated digital televisions. Civolution’s NexGuard – PayTV & Online solution, for instance, is integrated with ST, Broadcom and NXP and has been pre-integrated into Philips TVs designed for the hospitality market. Software integration means watermarking can even be deployed in an existing population of HD set-top boxes.

Set-top box vendors are now proactively embracing this technology – a clear indication that the PayTV industry wants to pursue this market opportunity. The processing and memory footprint for watermarking is small, which means it can be applied in any device capable of playing out HD content. Watermarking is now available through hardware silicon integration as well, making integration even easier.

“Having already invested in high-definition and Video on Demand (VOD) infrastructure, platform operators can expect high returns from early-release HD with minimal additional investment. In fact, together with 3D television it represents one of the best business opportunities for PayTV and hospitality during the next few years”

How digital watermarking works

Digital watermarking embeds data into video in real-time when the content is streamed from a video server or when it is passing through a set-top box or other television playout device.

Good quality watermarking solutions ensure watermarks are imperceptible to the human eye and that they can withstand the most sophisticated attempts to remove them. This means that it is robust against digital or analogue re-distribution, compression to very low bit rates, camcorder capture, scaling and cropping, for example.

The data embedded into the video provides unique information that can be used to identify when and where the content was originally consumed – right down to the level of a set-top box or hotel transaction. Watermarking solutions need to be efficient, scalable and they need a low processing footprint so they can fit easily onto set-top boxes.

Watermarking addresses the piracy threat in the ‘analogue hole’ after digital video has been decoded and the encryption has been removed. It cannot physically prevent the illegal copying of an analogue video output source but it provides a deterrent by ensuring that the ‘pirate’ is no longer anonymous and can be identified.

Civolution’s watermarking can be used on any digital TV platform (satellite, IPTV, cable and digital terrestrial TV) and can be used with linear and non-linear content, including VOD, near-VOD and push-VOD. The NexGuard – PayTV & Online solution also gives the flexibility to architect their watermarking solution to meet their precise needs.

Baseband vs Compressed video watermarking

For PayTV and On-line delivery operations two types of watermarking insertions are possible, one is in the baseband video and the other is in the compressed video.

NexGuard - PayTV-B inserts the watermark in baseband video. This will be done in the device after the video is decoded and just before it is available on the display.

Watermarking a compressed video stream is computationally too demanding for a regular video processing chip, especially under real-time playback constraints.

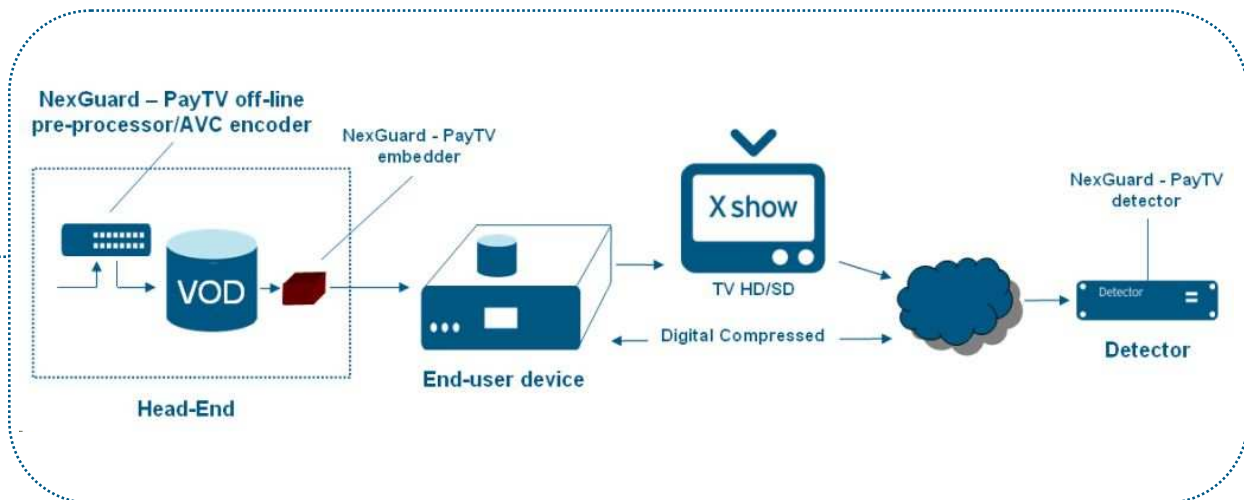
NexGuard - PayTV-C overcomes this challenge by implementing a two step process to watermark embedding. First, pre-processing is performed at the head-end, where more computational resources are available and prior to distribution of the content to a digital video device. A unique identifier is then inserted into the pre-processed, compressed video stream at or after the moment it is distributed. This is an efficient embedding process that has low computational requirements.

NexGuard - PayTV-C avoids head-end scalability issues by performing pre-processing only once for each video asset. The result of the pre-processing step is a compliant compressed file with extra side-information, which are both inserted into the same transport stream.

NexGuard – PayTV & Online is designed to work in the compressed-domain and can insert the watermark directly into the compressed video bit-stream. The resulting bit-stream can be played back on the subscriber’s device or, if desired, can be exported to a connected device. This approach is particularly suited to service providers that want to support home distribution networks.

VOD server integration for compressed video

With sever side watermarking the two-stage approach is used. Both the pre-processing and embedding performed at the head-end. Server side watermarking is used in two-way networks like cable, IPTV or other on-line delivery networks. This approach does not require integration in the end-user devices.



The pre-processing already embeds an operator specific watermark and makes the content traceable before it is distributed. After pre-processing, the compressed video stream is stored on the VOD server. When a request is made to the VOD server to deliver content to a particular device, the unique session ID and timestamp are embedded in the video stream just before it is delivered. The extra information in the transport stream facilitates an extremely efficient watermark embedding.

The payload is built from a static part, inserted during pre-processing at the head-end, and a dynamic part that is inserted at the end-used device. The static part can typically hold an 8 bit operator-ID and the dynamic part has the unique 32 bit ID and 16 bit date & time information.

Benefits

- Compressed video embedding allows support of home distribution networks
- High scalability, imperceptibility and robustness
- Watermark remains detectable even after camcorder copying or severe quality degradation
- No end-user device integration
- Static payload at pre-processing makes content traceable before distribution

Cooperating to counter criminal-level attacks

The content industry constantly monitors movie and television distribution worldwide and if a movie has been illegally copied, a digital watermark detector will reveal the source. Because of its flexible architecture, the NexGuard – PayTV & Online solution can enable a hierarchical approach to digital watermarking. Platform operators can embed unique operator IDs into movies when they are broadcasted or streamed from the video server, then add unique user IDs within the play out devices.

Content owners are only able to detect the operator ID and can inform their distribution partners about unauthorized copying, leaving the PayTV operators to identify the individual household responsible by detecting the user ID.

Different deterrent policies can be applied, from service termination to the involvement of law enforcement agencies. It is important that all parties work together in the interests of maintaining the value of an early-release HD content window. Stakeholders must also acknowledge the need to tread carefully where subscriber copyright infringements are detected.

People who make honest mistakes have nothing to fear from watermarking. The content industry views this technology as a way to counter criminal-level attacks and by deterring content theft it helps to support a sustainable content industry. Watermarking is consumer-friendly. It does not block access to content or limit fair use of content within the consumer home or even on mobile video devices. It does not force any behavioural changes upon honest multimedia users but provides a genuine deterrent to those that do not respect intellectual property rights.

Improving the economics of PayTV

The cost of introducing watermarking is a fraction of what operators have already invested in content protection and the extra expenditure will enable important new revenue streams. This technology can easily be justified on the basis of early-release HD but PayTV providers can then apply it to other premium content. In some markets, watermarking can also be used to identify the source of illegal (analogue) signal redistribution after digital content has been decoded and decrypted.

The stars have aligned for digital watermarking. The technology is mature and proven; the cost of deployment is low (partly thanks to pre-integration) and consumers want better content in high-definition. Both PayTV operators and content owners recognize the market opportunity for early-release HD.

However, changing release windows is a significant undertaking with implications for the entire content ecosystem. The industry needs a market-wide approach to early-release HD. Consumers need to be aware that there is a new release window and the model is not sustainable if only a handful of operators and content owners introduce it. We are confident this new window will be adopted over the next few years.

The first large scale deployments of watermarking for early-release HD content in Pay-TV are happening now and are using Civolution technologies. This is a significant development for digital watermarking technology, for content owners and the PayTV industry. This market for watermarking will be driven by the high margins available on premium content - early-release HD movies - and we believe the economics will prove impossible to ignore for any PayTV operator interested in the premium content market.

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Monetizing content throughout its life

Civolution provides the end-to-end technology solutions and services that enable the media industry to identify, manage and monetize content. The NexGuard product portfolio means content owners and their distribution partners can work together to maintain the integrity of each release window while exploring new business opportunities.

The NexGuard product range includes: NexGuard - Pre-release for audio & video pre-release stage; NexGuard - Digital Cinema for forensic tracking in digital cinemas; NexGuard – PayTV & Online for PayTV and hospitality (hotels, linear broadcast, VOD).

Civolution enables content owners to enforce their Intellectual Property rights and monetize their content via all distribution mechanisms, including the Internet, and also provides audience measurement, broadcast and online monitoring solutions. Digital watermarking is an important part of this content lifecycle. Civolution also provides content tracking solutions, which already ensures that motion picture studios, news organizations, network and syndicated TV programmers, sports rights holders, advertisers and corporate communicators can manage and generate new revenues from their content assets.



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Civolution is a leading provider of technology and solutions for identifying, managing and monetizing media content. Civolution offers an extensive portfolio of watermarking and fingerprinting technology applications for forensic tracking of media assets in pre-release, digital cinema, PayTV and online. Through its solution portfolio, Civolution offers world-class broadcast and internet intelligence to help media content owners control their assets and unlock new revenue streams.

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