



Identify | Manage | Monetize

Automated Content Recognition creating content aware ecosystems



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A White Paper by **Civolution**, 2013

Table of content:

1.0 Introduction	3
2.0 Automatic Content Recognition - how it works	4
3.0 Key ACR technologies	6
3.1 Audio Watermarking	6
3.2 Fingerprinting	8
4.0 Smart Services	12
4.1 Real-time advertisement notification	12
4.2 Real-time provisioning of keyword extraction information	12
5.0 Case study examples	13
5.1 ACR in practice - smart/Connected TVs	13
5.2 ACR in practice - 2 nd Screen enablement	13
6.0 Conclusion	15

1.0 Introduction

Automatic Content Recognition is the Catalyst for Content Consumption in the Living Room : driving interaction, monetisation and creativity

The way people watch TV is changing rapidly. What used to be a passive and lean-back experience is now becoming an interactive and engaging experience. Consumers use their 2nd screen devices - such as smart phones, tablets, laptops - to search, interact and engage with a rich variety of 2nd screen applications, websites and communities while still watching the TV. The next generation TVs are also connected and - similar to the 2nd screen devices - offer access to a wide variety of first screen applications.

A very recent research from Deloitte showed that nearly half of all 16-24 year olds use messaging, email, Facebook or Twitter to discuss what they are viewing on TV. In fact 24% of all respondents use second screens.

This growing consumers' appetite for interactivity opens opportunities for broadcasters, content owners and advertising agencies to deepen their relationship with the consumer. Adding interactive applications to companion devices and smart TVs meets the demands of today's media consumers and offers new monetization opportunities for targeted applications and advertising.

Automatic Content Recognition (ACR) will power the majority of these next generation interactive applications. Automatic recognition and precise synchronization - between TV programming and the interactive applications running on smart TVs and 2nd screen devices - greatly enhances the TV viewing experience. ACR is bringing a wealth of new possibilities to the broadcast industry.



Civolution operates as an independent Automatic Content Recognition (ACR), synchronization and triggering technology, and services supplier. Civolution offers best of breed solutions to enable broadcasters, operators and application developers to build the best possible user experience that scales up to millions of concurrent users and hundreds of TV channels.

2.0 Automatic Content Recognition - the basics on how it works

In its very simplest definition, **ACR** technology gives a smart device such as a tablet, smartphone, or smart TV the ability to become 'content-aware' and 'know' what content is being watched. The device can then deliver complementary and fully synchronized content associated with the viewed program, film or advertisement. The viewer's experience is automatically enhanced without the need for any manual interaction. The viewer can then use its companion device or the smart TV to access other applications and social networking tools (to share their experiences with friends, family and on-line communities) driving up viewing figures and dragging customers into branded virtual spaces.

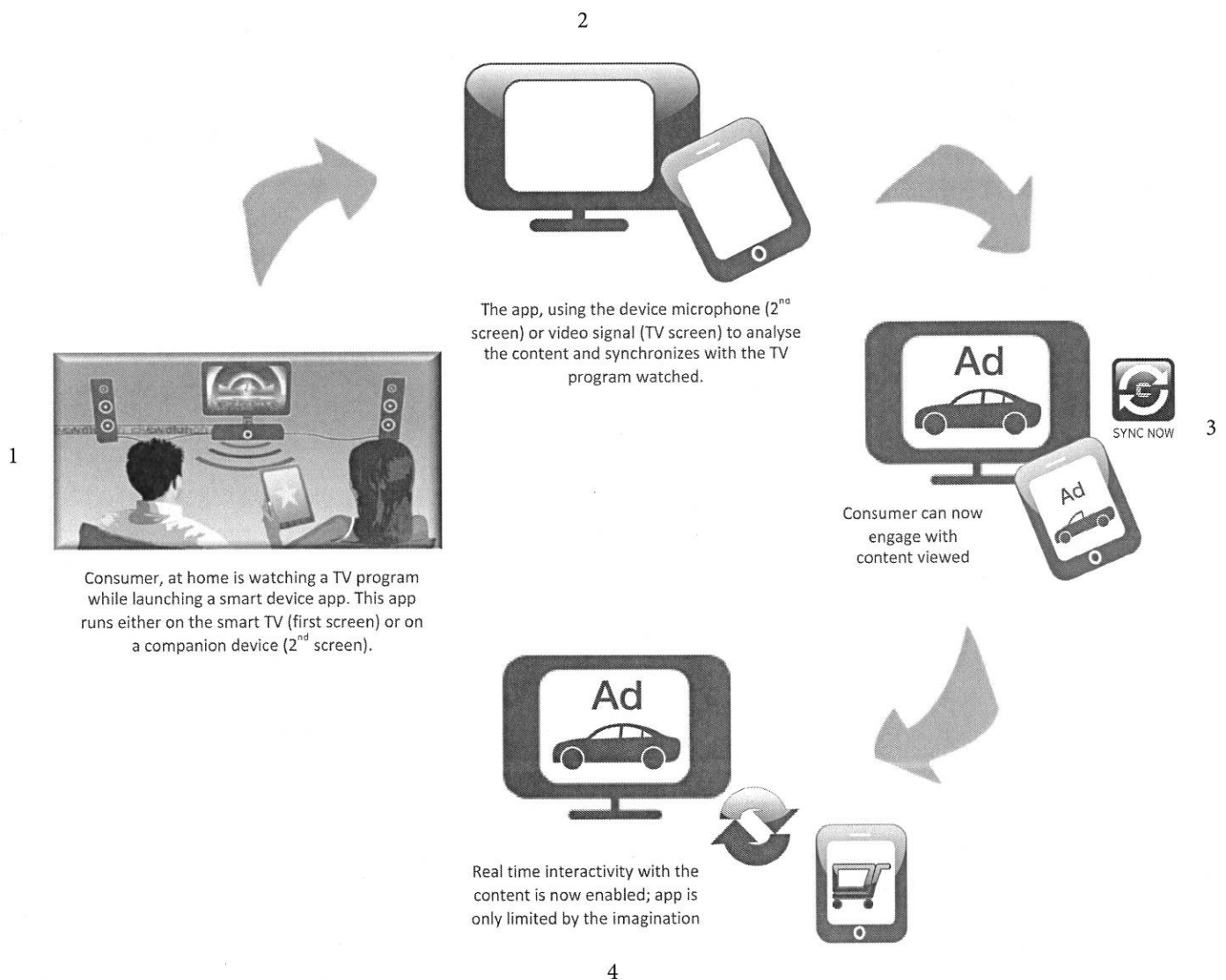


Fig.2: Basic ACR overview

The identification of the TV channel and the content being watched is fully automated. It relies on ACR technology which natively handles delays between **different transmission** networks and supports **time-shifted viewing**. Also the identification of **premium VOD** archives and **legacy content** is supported by ACR technologies.

Example: smart TVs

The next generation smart TVs have access to a wide variety of applications. A large number of these applications will be powered by ACR. Examples of ACR enabled applications for smart TVs are:

- offering additional information related to the content being watched to enhance the consumer experience
- offering interactivity related to the content being watched to increase consumer engagement
- targeted advertisements and advanced product placement
- offering additional services to enhance the consumer experience, such as frame accurate parental rating (e.g. violent scenes can be cut out) or frame accurate subtitle services
- offering granular audience measurement information allowing for detailed viewing behavior analyses



Fig. 3: overview of possible ACR enabled first screen applications

Example: Companion Devices

Smart phones, tablets and laptops enable consumers to search, interact and engage with a rich variety of 2nd screen applications. Examples of ACR enable applications for 2nd screen are:

- offering synchronized background info services by automatic channels / program identification
- accurate time synchronization enabling voting / polling services
- synchronized ad placement on the 2nd screen
- offering granular audience measurement information allowing for detailed viewing behavior analyses

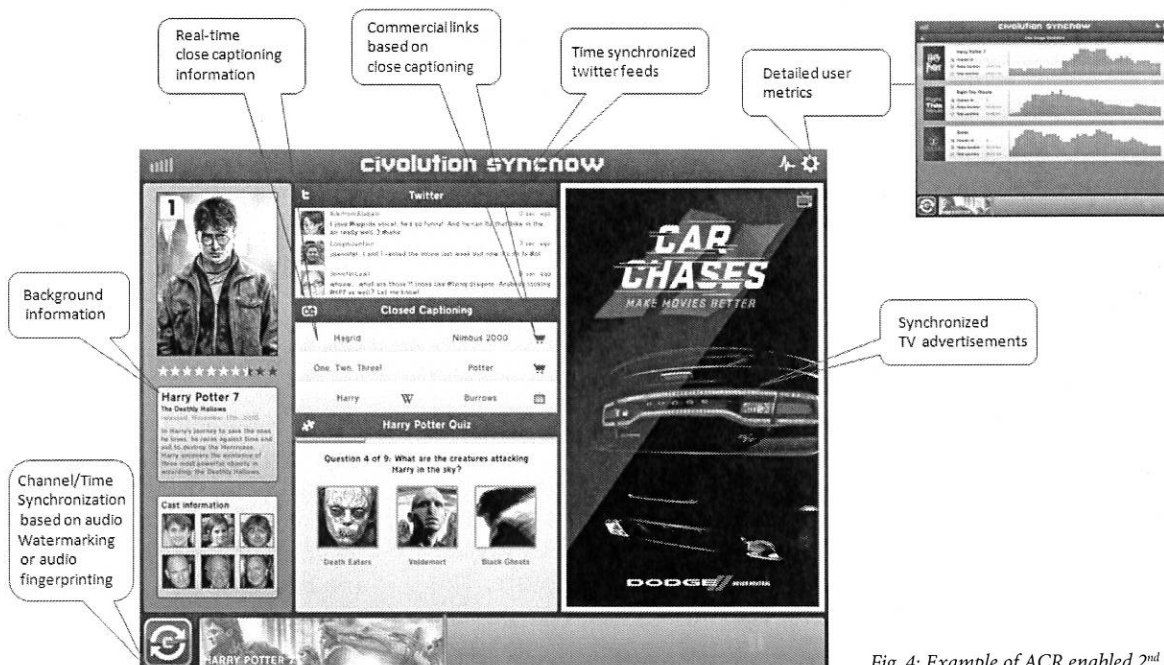


Fig. 4: Example of ACR enabled 2nd screen applications

By being content aware, the connected device can make use of the broadband connection to retrieve additional content related information. The ACR identification client runs in the background on the smart TV or the companion device itself. Upon instantaneous identification the ACR application has access to a channel ID, a program ID and frame accurate time-stamp info. Such information enables content owners, TV channels and advertisers to offer more immersive event-based viewing experiences which offers deeper engagement to consumers and a higher stickiness to the program.

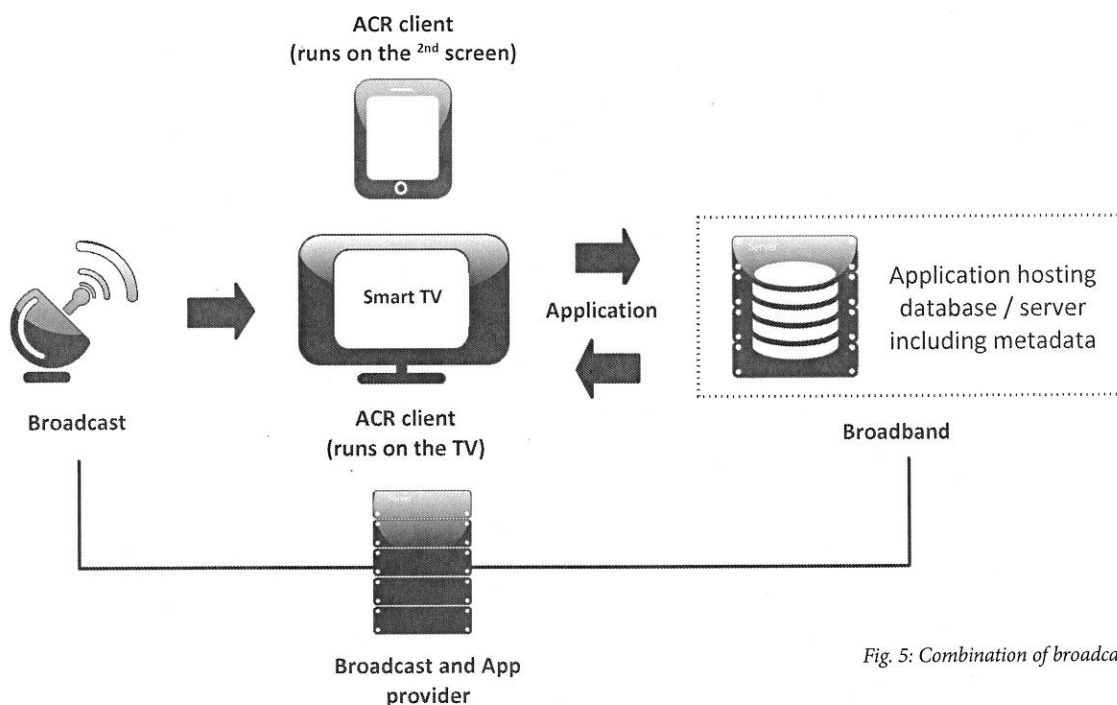


Fig. 5: Combination of broadcast and broadband.

3.0 Key ACR technologies: watermarking and fingerprinting

There are two ACR technologies: **digital fingerprinting** and **digital audio watermarking**.

Watermarking is about inserting a payload or specific Channel/Program ID and time-stamp information in the content which can be retrieved later. **Fingerprinting** is about analysing and comparing content with a reference database. Both technologies are commercially deployed today.

Civolution is currently the only vendor in the marketplace able to provide both fingerprinting and watermarking ACR solutions. Civolution works directly with content owners, PayTV providers, broadcasters and advertisers, as well as technology partners who have incorporated the technology into their own platforms.

3.1 Audio Watermarking

Watermarking involves the dynamic **insertion** of a digital Tag containing specific information - such as program ID, channel ID and time code - into audio content prior to broadcast distribution. The watermark is inaudible to the consumer and is robust against all sorts of signal processing. Civolution watermarking technology is robust even in case of noisy environment. The audio watermark or so called 'payload' can be quickly retrieved with the appropriate audio watermark detection software. This resource efficient software runs on an end-user device such as a smart TV, tablet, smartphone or laptop.

Smart Services

In addition to synchronization services Civolution has developed two ACR related Smart Services.

> see more information on page 11

Real time advertisement notification: this service allows TV broadcasters, operators and 2nd screen companies to further optimize the monetization of TV ads.

Real time provisioning of keywords extracted from the broadcast: this service allows 2nd screen providers to offer relevant, engaging information to viewers.

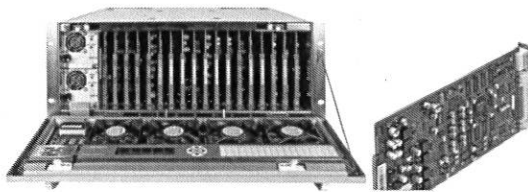
What is a Payload?

A payload refers to a unit of information embedded within the audio track(s) of a piece of content and continuously repeated throughout the timeline. It includes a content / channel identifier and a time code or triggering information.

Embedding the watermark

Audio watermarks can be inserted at any point of the distribution workflow.

Production/Live - Operating in real-time, the watermark system inserts watermarks at the head-end providing accurate time stamps and channel IDs for synchronization. The live solution supports transmission standards such as AES-EBU, SD-SDI and HD-SDI.



Live embedder (audio watermarking): a professional broadcast-grade modular rack frame product that embeds audio watermarks in typically up to 8 audio channels per watermarking boards. The modular solution, based on Axon Synapse broadcast-grade, offers a wide range of I/O options to support any signal format commonly used (including Dolby E, 5.1/7.1 stereo, mono ..., etc). The unit supports redundancy architectures and emergency security functions.

Post-production - Two types of solutions are available, either file watermarking for selected file formats (MXF, GXF, PCM and MPEG) or watermarking upon transcoding (Rhozet Carbon Coder, Minnetonka Audio Server Tool).

Q/A - The audio watermarking Quality Control Reader checks whether the content is properly embedded and constantly monitors the audio watermark embedding process on live signals. This process information can be integrated with any existing monitoring systems.

Detecting the Watermark

ACR watermark Software client has minimal footprint and is easy to integrate. The client SDK is available for iOS, Android as well as standard protocols to support most common web browsers (PC or MacOS). Input to the application is received in the form of Raw PCM and the watermark payload is decoded to produce an ID and timestamp.

After the brief initial synchronization, the timestamp is frame accurate. The interactive application can then apply the list of interactive actions on time, even in case of time-shifted viewing.

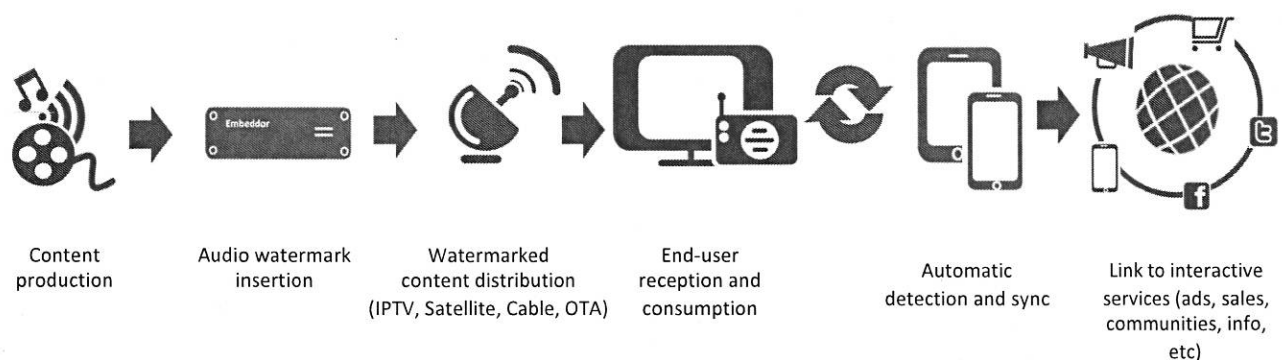


Fig. 6: Example of a typical audio watermark workflow for 2nd screen applications

1. Content (show, advertisement or movie ...) is distributed to the primary TV
2. SyncNow, hosted on a smart device (ie: iPad), automatically identifies the TV content
3. SyncNow automatically synchronizes with the program regardless of time-shift (network latency, PVR recording, or "Catch-up TV")
4. A third party application on the smart device (embedded with SyncNow) triggers events / interactive content: exclusives, coupons, polling, chats, social media and much more!

Civolution Audio Watermark properties

Granularity

Civolution's audio watermark algorithm detects watermark from incoming audio frames. Depending on the watermark payload, the detection time varies between 3 and 7 seconds.

Resolution/Accuracy

For each watermark identification, the Civolution software returns a reference time code. This time code reference allows for frame-accurate synchronization.

Latency

The Civolution audio watermark solution and software need as little as few seconds of content to have a reliable first recognition. This means that after a few seconds a viewer tuned in to a TV program, the applicable ACR application will provide the synchronization information.

Footprint

The Civolution Embedded Watermarking SDK has a small footprint.

3.2 Fingerprinting

While watermarking involves the active insertion of a digital tag into the content itself, fingerprinting analyses the unique characteristics of an audio or video file and compare these against 'reference' digital fingerprints stored in a remote database. Upon identification, the associated meta-data such as channel ID, program ID and time stamp info is retrieved from the database.

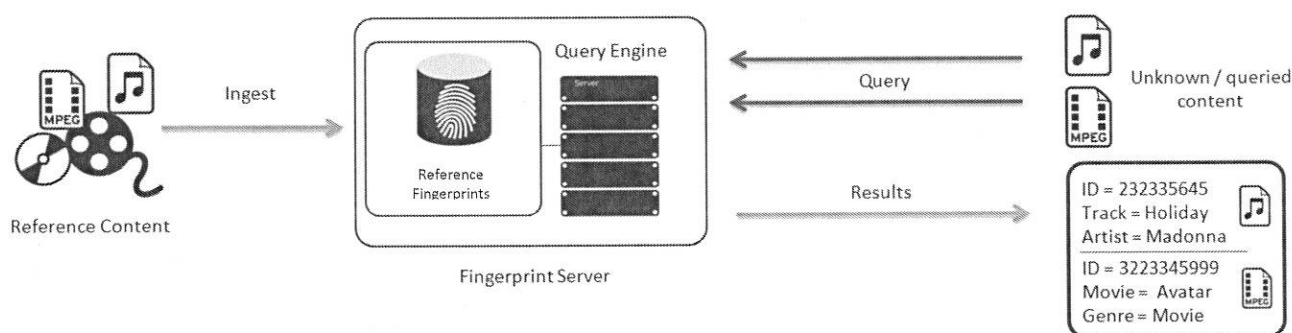


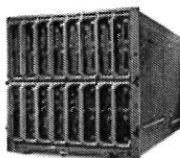
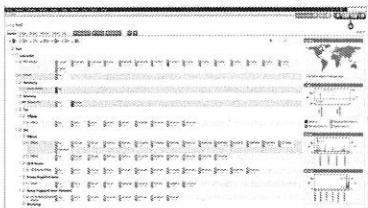
Fig. 7: Fingerprint workflow

One of the key characteristics of fingerprinting is that it does not modify the original content. As a result, fingerprint technology also supports legacy content. The creation of a fingerprint involves the use of specialized software that decodes the audio/video content and extracts uniquely identifiable features. Digital fingerprints are highly compressed when compared to the original source file and can therefore be easily stored in databases for later comparison. Fingerprints cannot be used to reconstruct the original content. The Civolution fingerprinting system is able to identify audio/video content using excerpts as short as just a few seconds of content.

Generating Reference Fingerprints

Using Civolution's SyncNow solution, video reference fingerprints can be generated at any point of the distribution workflow.

Live - Operating in real-time, the fingerprint generation system generates video fingerprints from live TV broadcast stations. The live solution supports IP streams and SDI inputs. Civolution uses its worldwide broadcast monitoring network to generate reference fingerprints of popular TV channels.



*Civolution offers a multi-channel **real-time fingerprinting** generation solution based on standard professional server hardware that works parallel to the existing Network infrastructure.*

Post-production - a variety of tools is available to support any file-based fingerprint generation workflow; from a single file to the automatic processing of large content archives

ACR Fingerprinting Software Client

The Civolution Embedded Fingerprinting SDK (video) is highly portable and has a very low resource footprint. Developers can easily incorporate automatic content recognition and synchronization into various smart devices including smart TV sets and handheld devices.

The input to the embedded SDK is a sequence of uncompressed frames (video) with associated time stamps. Every few seconds, the embedded SDK generates an identification request which queries the fingerprint server and reports the resulting identification.

Matching the fingerprint

Central matching - the central fingerprint database is fully scalable and can run in the cloud. It is capable of serving hundred thousands of clients (smart TVs, companion devices) at the same time. The fingerprint database is updated in real-time and can hold tens of thousands of hours of content whilst keeping a good quality of service. it uses standard APIs to offer access to identification information.

Local matching - In addition to the "central matching" approach, Civolution provides "distributed" matching. In this distributed approach, the reference fingerprints are pushed to the device, where a separate, lean-and-mean "local matching" process is running. The device only contains a subset of relevant reference fingerprints, which can be updated on demand.

Reference Databases

Civolution owns and operates three reference fingerprint databases to support its customers:

- **Live TV database:** Civolution's global TV monitoring offers hundreds of channels that support real-time reference fingerprint generation.
- **Premium content database:** Civolution has access to a large database containing the most popular movies, TV series, documentaries and concerts.
- **Advertisement database:** containing current broadcast TV ads, this database grows daily through Civolution's automatic ad harvesting processes. Civolution currently supports ads in the UK and in the U.S.A.

Global TV monitoring network

Civolution operates one of the world's largest TV monitoring networks. The total network covers more than **1,900 channels** worldwide and more than 1,300 channels in the US. For its Fingerprint-based SyncNow services Civolution added the capability to generate reference fingerprints in real-time for a large number of channels. These fingerprints are stored in a fingerprint database and used for channel identification and synchronization.



Civolution monitoring location

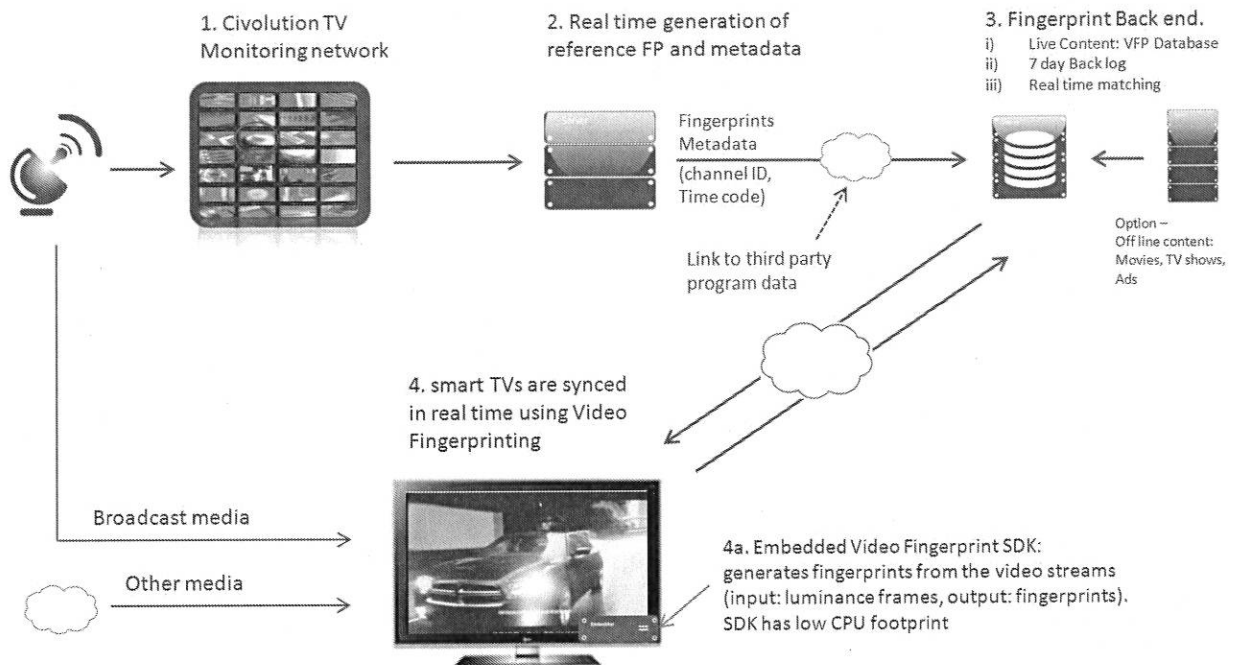


Fig. 8: SyncNow fingerprint system overview for smart TVs (based on video fingerprinting)

Civolution Fingerprint Properties

Granularity

Civolution's fingerprinting algorithm has been enhanced and optimized allowing content recognition using only a few seconds of video content; generally about 3 to 5 seconds.

Resolution/Accuracy

For each fingerprint match, the Civolution fingerprint software returns a reference time code allowing for frame-accurate synchronization.

Latency

The Civolution fingerprint software needs as little as few seconds of content to have a reliable first match. This means that after a few seconds a viewer has tuned in to a TV program, the TV will recognize this program and can launch the related application.

False positive and false negative rates

When working to identify potential matches, the fingerprint server computes a distance metric between the reference and candidate blocks. An identification result is only returned when this distance is below a threshold. An optimum threshold has been determined which yields extremely low false positive rates, even for very large fingerprints database.

Scalability and efficiency of the fingerprint server

Civolution currently hosts one of the world's largest reference fingerprint databases. Its fingerprint identification back-end is designed for scalability and has already been running in the field for more than 5 years. The identification interface allows serving massive identification requests in a swift manner. In addition to the "central matching" approach, Civolution provides "distributed" matching. In this distributed approach, the reference fingerprints are pushed to the device, where a separate, lean-and-mean "local matching" process is running. The device contains only a subset of relevant reference fingerprints, which can be updated on demand.

Footprint

The Civolution Embedded Fingerprinting SDK has a very small footprint. On a typical smart TV chipset the CPU load is less than a few percent.

ACR powers a wide variety of applications

Where?	ACR Examples
With TV shows	Background information, social media opt-in, voting, polling, to-show messaging, related purchases, recommendation, targeted advertising, additional features, audience measurement
With ads	Purchases, product information, social media opt-in, polling, ad interaction, coupons, loyalty programs, product specials, product releases, synchronized ad placements
With sport	Polling, in-game betting, alternative viewing angles, targeted advertising, sponsor content, social media opt-in, kit and club purchases
With radio	Visual support content, background information, voting, to-show messaging, targeted advertising, related purchases, social media opt-in
At the movies	Additional content, language-selectable subtitling, merchandising, video pre-orders, social media opt-in, product placement link-ins
At the shops	In shop promotions, targeted advertisements, in shop interaction, product information , social media opt in

4.0 Smart Services

In addition to the ACR synchronization technologies Civolution has developed two ACR related Smart Services. These services can be used in conjunction with ACR synchronization technologies or as stand-alone services.

1. Real-time advertisement notification.
2. Real-time provisioning of keyword extraction information.

4.1 Real-time advertisement notification

This service allows application providers for first or 2nd screen to create synchronized, interactive and targeted advertisements on the first or 2nd screen. This will help improve consumer stickiness and advertising reach.

This smart service identifies in real-time all TV broadcast advertisements working independently from the broadcaster and operator. Civolution uses its own global TV monitoring network to identify the ads being aired using video fingerprinting technology for the advertisement identification.

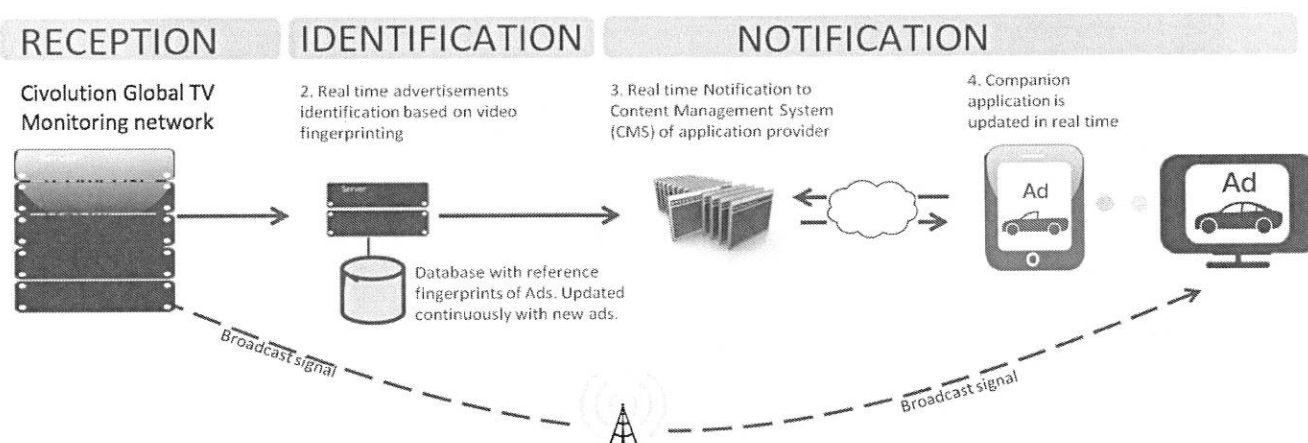


Fig.9: Real-time advertisement identification and notification

This smart service offers a major advantage in that the client implementation is very straightforward and truly lightweight, as there is no need to run fingerprinting or watermarking detections on the device itself. It is a complete server-side application with signal acquisition taking place at the head-end. The data triggers are directly sent to the 2nd screen application content server.

Civolution created and maintains an up to date **Advertisement Database**. It relies on an **Intelligent Advertisement Harvesting** process and key metadata such as brand name, product name and product categories are stored in the database.

4.2 Real-time keyword extraction

This service allows application providers for first or 2nd screen to source metadata in real-time, from the broadcast signal that is either derived from pre-recorded or live content. This metadata can be used in various ways:

- to enhance the consume experience by offering background information retrieved from the internet directly related to the broadcasted content.
- to drive direct purchase by offering a click through experience based on products or services referred to in the broadcasted content.

This service provides real-time keyword extraction information to 2nd screen application providers. Similar to the advertisement notification service, the client device (2nd screen) is not required to do any listening or matching. It is an integrated server-side application - signal acquisition and signal processing is done at the Civolution head-end. The keyword extraction data are directly sent to the 2nd screen providers' back end.

5.0 Case study examples

5.1 ACR in practice - smart/connected TVs



Broadcom - By integrating an on-device video fingerprinting ACR solution onto Broadcom chips used smart set-top boxes, Civolution is enabling a new real-time content identification and triggering of events at device level. It enables synchronized smart devices to become content-aware and offer a host of value-added features for the consumers and potential for revenue generating solutions such as advertising overlays.

5.2 ACR in practice - 2nd Screen enablement



ConnecTV - Powered by Civolution's award-winning SyncNow technology, ConnecTV's social TV platform uses Civolution's audio fingerprinting solution to enable consumers to automatically sync with their favourite TV programs and compelling companion content.

Civolution's technology has been integrated with ConnecTV's platform to provide a highly relevant and accurate synchronization for sports programs. This allows networks and content providers to deliver an engaging, fun, and social TV experience.



ExMachina - A leading pioneer in providing live online interaction with events, the company has developed a platform, PlayToTV, which enables TV shows such as talent contests, sports, game shows and reality programs to provide real-time and social interaction such as live rating, voting, polling, quizzes, chat and twitter feed aggregation. ExMachina has already provided interactivity for shows such as The Voice of Holland and Germany's Next Top Model.



Red Bee Media - formerly BBC Broadcast, RedBee Media is a media management company. Red Bee Media created and produced the first companion app for Fox's FX UK channel. The app is related to top rated TV series "The Walking Dead". It is a free app for iPad and iPhone. Thanks to episode identification (right from the opening credits) and time synchronization, users can predict the number of zombie kills while watching an episode, share results on social networks and enjoy bonuses.

This was truly a killer app. with some astonishing facts:

- The Walking Dead returned to FX after its winter hiatus and drew nearly three times more than the channel's usual audience with 324,000 viewers.
- Made the top ten list in the iTunes App Store during the first week
- 62,000 downloads in the first 60 days
- 300,000 gameplays in the first 60 days
- 37.8% uplift in viewers
- 65.3% jump in audience share

HyperTV



HyperTV - has developed eXperience, a multimedia platform to create and publish user experiences that encompass PCs, Tablets and smartphones. Selected by Sky Italia, Hyper TV developed a specific application for the XFactor live show in Italy, enabling consumer as home to take part in the event, vote, share their opinions online with their community, chat and much more, all in real-time.

ensequence

Ensequence - Using Civolution technology, Ensequence's iTV Manager® platform identifies what viewers are watching on their televisions or PCs and enables programmers and content publishers to create, manage and deliver immersive 2nd screen experiences for TV shows and commercials. Ensequence software and services helps build a scalable interactive TV business, which dramatically increases viewer engagement and advertising revenue. It combines technical power with a highly visual and easy to use environment and gives the flexibility to build and deploy a wide range of interactive TV experiences. The rapid scale that Ensequence provides helps programmers and advertisers generate incremental revenue and manage their businesses more effectively and efficiently.

5.3 ACR in practice - Smart Services



DG®, the world's leading ad management and distribution platform is now using the service for its dual-screen video ad platform. It allows applications running on 2nd screens, such as smartphones and tablets, to automatically recognize the content being played on the 'first' screen, the TV, and synchronizes with it. Upon synchronization, specific and relevant content can be triggered to the 2nd screen enabling consumers to benefit from enriched brand engagement, without any interruption to their primary viewing experience. To enable integrated advertising across multiple screens and devices, the platform leverages DG's asset tagging and metadata, Civolution's Automatic Content Recognition, and mobile video ad serving from MediaMind, a division of DG. Commercials broadcast by DG are automatically recognized in real-time using Civolution's SyncNow - Smart Services and tapping into its extensive television monitoring infrastructure already in place.

Why Civolution for ACR?

Civolution has deep and strong IPR portfolio and R&D roots stemming from its spin-out from Philips and the subsequent acquisition of Thomson content ID activities.

Civolution is the trusted provider of Content ID solutions to all the major Hollywood studios and broadcasters.

Civolution offers 2nd screen synchronization solutions for smartphones and tablets which can be combined with its smart TV-based ACR solutions.

Civolution offers access to the world's largest TV monitoring network.

ACR allows broadcasters to gather viewing statistics from their audience and drastically improve CRM systems.

Civolution has demonstrated and proven the scalability of its fingerprinting back-end system through its large scale commercial deployments in music.

In addition to the ACR synchronisation technologies Civolution has developed two ACR related Smart Services. These services can be used in conjunction with ACR synchronization technologies or as stand-alone services.

6.0 Conclusion

The emergence and rapid rise of companion devices and smart TVs is spearheading a media revolution, bringing media consumption to another level of engagement and interaction.

Given the trend of cross-platform device usage, you would expect that synchronized content is always about a viewer watching TV with a secondary device in hand. While that behaviour isn't expected to go away, there will likely be a growing number who will watch and interact via the (smart) TV alone.

Research firm DisplaySearch reported that 27% of TVs shipped worldwide last year were capable of connecting to the Internet. That figure is expected to rise 54% by 2015 to 155 million.

Utilizing ACR is more than just creating compelling content. ACR enables a wealth of new opportunities:

- By offering additional content related to the content on the main screen, the TV consumer experience can be greatly enhanced.
- Broadcaster can increase consumer engagement by offering synchronized applications on the main or second screen.
- Once synchronized applications are available to consumers, they will also offer much better insights in viewing and interactional behaviour to the broadcaster.
- Advertising can be greatly enhanced:
 - Synchronized companion ads can be offered on the 2nd screen
 - Ads can be made interactive synchronized to the main screen
 - Addressable ads can be offered on the 2nd and main screen

An entire industry ecosystem is gradually coalescing around ACR in which TV manufacturers, application developers, broadcasters, advertisers and rights holders will all be playing their respective parts for the benefits of all. ACR plays a crucial role in establishing this new eco- system.



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