

Digital Video Broadcasting (DVB); Content Protection and Copy Management (DVB-CPCM); Part 13: CPCM Compliance Framework



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Foreword

This Technical Report (TR) has been produced by Joint Technical Committee (JTC) Broadcast of the European Broadcasting Union (EBU), Comité Européen de Normalisation ELECTrotechnique (CENELEC) and the European Telecommunications Standards Institute (ETSI).

NOTE: The EBU/ETSI JTC Broadcast was established in 1990 to co-ordinate the drafting of standards in the specific field of broadcasting and related fields. Since 1995 the JTC Broadcast became a tripartite body by including in the Memorandum of Understanding also CENELEC, which is responsible for the standardization of radio and television receivers. The EBU is a professional association of broadcasting organizations whose work includes the co-ordination of its members' activities in the technical, legal, programme-making and programme-exchange domains. The EBU has active members in about 60 countries in the European broadcasting area; its headquarters is in Geneva.

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The Digital Video Broadcasting Project (DVB) is an industry-led consortium of broadcasters, manufacturers, network operators, software developers, regulatory bodies, content owners and others committed to designing global standards for the delivery of digital television and data services. DVB fosters market driven solutions that meet the needs and economic circumstances of broadcast industry stakeholders and consumers. DVB standards cover all aspects of digital television from transmission through interfacing, conditional access and interactivity for digital video, audio and data. The consortium came together in 1993 to provide global standardisation, interoperability and future proof specifications.

The present document is part 13 of a multi-part deliverable. Full details of the entire series can be found in part 1 [i.3].

Introduction

CPCM is a system for Content Protection and Copy Management of commercial digital content delivered to consumer products. CPCM manages content usage from acquisition into the CPCM system until final consumption, or export from the CPCM system, in accordance with the particular usage rules of that content. Possible sources for commercial digital content include broadcast (e.g. cable, satellite, and terrestrial), Internet-based services, packaged media, and mobile services, among others. CPCM is intended for use in protecting all types of content - audio, video and associated applications and data. CPCM specifications facilitate interoperability of such content after acquisition into CPCM by networked consumer devices for both home networking and remote access.

This first phase of the CPCM specification suite addresses CPCM for digital Content encoded and transported by linear transport systems in accordance with TS 101 154 [i.1]. A later second phase will address CPCM for Content encoded and transported by systems that are based upon Internet Protocols in accordance with TS 102 005 [i.2].

1 Scope

The present informative document describes the Compliance Framework for the Digital Video Broadcasting (DVB) Content Protection and Copy Management (CPCM) system. Attention is drawn to those aspects of the CPCM specification which provide options for, and require decisions by, a compliance body. The rationale behind the options is explained. Attention is also drawn to areas where it will be necessary for a CPCM compliance body to reach agreement with other compliance bodies to enable secure integration with their content protection systems or secure delivery systems for the purposes of content acquisition into CPCM or export from CPCM.

2 References

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at <http://docbox.etsi.org/Reference>.

NOTE: While any hyperlinks included in this clause were valid at the time of publication ETSI cannot guarantee their long term validity.

2.1 Normative references

The following referenced documents are necessary for the application of the present document.

Not applicable.

2.2 Informative references

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

- [i.1] ETSI TS 101 154: "Digital Video Broadcasting (DVB); Specification for the use of Video and Audio Coding in Broadcasting Applications based on the MPEG-2 Transport Stream".
- [i.2] ETSI TS 102 005: "Digital Video Broadcasting (DVB); Specification for the use of Video and Audio Coding in DVB services delivered directly over IP protocols".
- [i.3] ETSI TS 102 825-1: "Digital Video Broadcasting (DVB); Content Protection and Copy Management (DVB-CPCM); Part 1: CPCM Abbreviations, Definitions and Terms".
- [i.4] ETSI TS 102 825-2: "Digital Video Broadcasting (DVB); Content Protection and Copy Management (DVB-CPCM); Part 2: CPCM Reference Model".
- [i.5] ETSI TS 102 825-10: "Digital Video Broadcasting (DVB); Content Protection and Copy Management (DVB-CPCM); Part 10: CPCM Acquisition, Consumption and Export Mappings".
- [i.6] ETSI TS 102 825-3: "Digital Video Broadcasting (DVB); Content Protection and Copy Management (DVB-CPCM); Part 3: CPCM Usage State Information".
- [i.7] ETSI TR 102 825-12: "Digital Video Broadcasting (DVB); Content Protection and Copy Management (DVB-CPCM); Part 12: CPCM Implementation Guidelines".
- [i.8] ETSI TS 102 825-4: "Digital Video Broadcasting (DVB); Content Protection and Copy Management (DVB-CPCM); Part 4: CPCM System Specification".
- [i.9] OMA-AD-DRM-V2-0-1: "DRM Architecture".
- [i.10] ETSI TS 102 825-9: "Digital Video Broadcasting (DVB); Content Protection and Copy Management (DVB-CPCM); Part 9: CPCM System Adaptation Layers".

- [i.11] ETSI TS 102 825-7 "Digital Video Broadcasting (DVB); Content Protection and Copy Management (DVB-CPCM); Part 7: CPCM Authorized Domain Management".
- [i.12] ETSI TS 102 825-14: "Digital Video Broadcasting (DVB); Content Protection and Copy Management (DVB-CPCM); Part 14: CPCM Extensions".
- [i.13] ETSI TS 102 825-5: "Digital Video Broadcasting (DVB); Content Protection and Copy Management (DVB-CPCM); Part 5: CPCM Security Toolbox".
- [i.14] ETSI EN 300 468: "Digital Video Broadcasting (DVB); Specification for Service Information (SI) in DVB systems".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in TS 102 825-1 [i.3] and the following apply:

C&R Regime IPR: intellectual property rights owned or licensed for further sub-licensing by a compliance body and incorporated into a Compliant Device by virtue of its compliance, not its conformance

NOTE: C&R Regime IPR is not essential IPR.

certificate authorities: entities which issue certificates for embedding into Compliant Devices in accordance with an agreement established with a compliance body

NOTE: A certificate authority can be operated directly by a compliance body.

Compliance and Robustness Regime (C&R Regime): set of rules and obligations established for the design, construction, operation and other aspects of a Compliant Device and other system elements intended to ensure that the CPCM protections afforded to content treated by the Compliant Device are not compromised

NOTE: A C&R Regime is coupled with testing and/or validation procedures. It is administered by a compliance body.

compliance: adherence of a Compliant Device to the rules of a C&R Regime

compliance body: entity which develops licences and governs the use of a C&R Regime

Compliant Device (CD): device that satisfies a C&R Regime

conformance: adherence of a product to the technical requirements of the specification

NOTE: Conformance may be achieved by means of self-certification.

conformant device: product meeting conformance

CPCM content: content intended to be protected by the trust model

NOTE: A CPCM content item invokes at least one rule set in a Compliant Device.

CPCM specification: group of normative specifications and informative supporting specifications produced and maintained by the DVB Project comprising the specification for DVB Content Protection and Copy Management

essential IPRs: intellectual property rights necessarily infringed when implementing the CPCM specification

licensor: holder of essential IPRs of the CPCM specification

revocation: process by which a compliance body declares that a list of CPCM instances cease to be compliant

revocation certificate: certificate used by a Compliant Device to verify the revocation list

Root Authority (RA): entity responsible for issuing certificates to entities qualifying as certificate authorities

NOTE: This is the Root Authority referred to in TS 102 825-5 [i.13].

signing certificate: digital data structure signed by its parent signing certificate or the Root Authority which is used in the verification of its descendant certificate which may be another signing certificate or a CIC

trust model: framework of contractual and other legal arrangements allowing confidence in the adequacy of the protection of CPCM content

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in TS 102 825-1 [i.3] and the following apply:

RA Root Authority

4 Introduction

4.1 Description of the CPCM system

CPCM identifies five essential functions which take place in digital devices in the consumer environment. TS 102 825 2 [i.4], the CPCM Reference Model, identifies these functions as: Acquisition, Storage, Consumption, Processing and Export. CPCM also provides for home network connectivity and remote access.

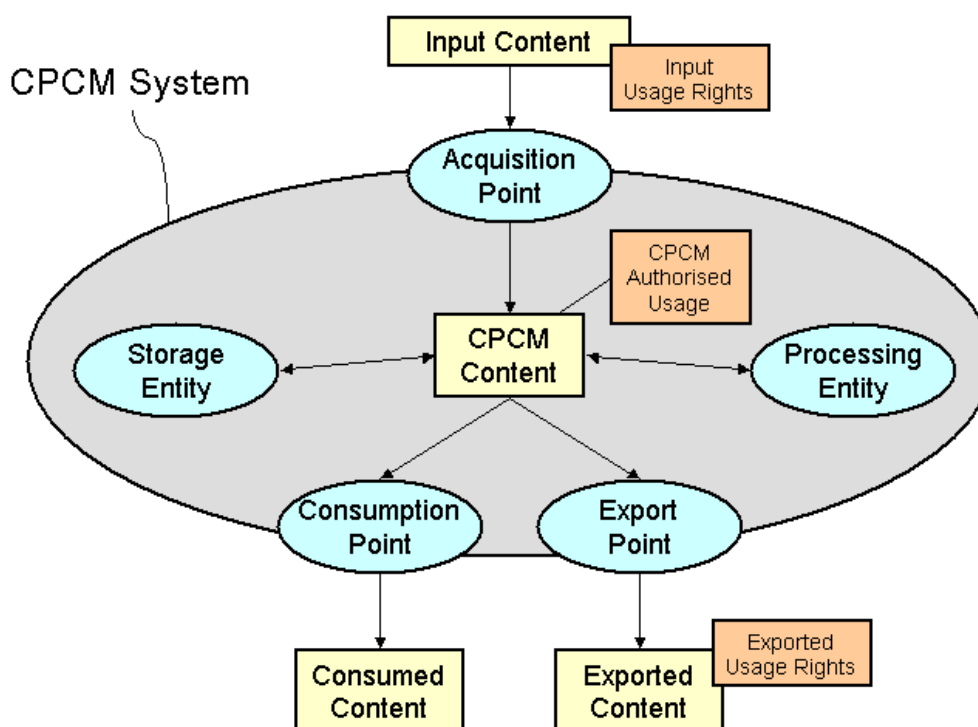


Figure 1: CPCM system overview

A CPCM conformant implementation is achieved by the existence of a CPCM conformant instance in a device.

- The CPCM instance implements the functionality defined in the CPCM specification.
- The security control element of a CPCM instance includes the set of CPCM cryptographic tools necessary to implement the CPCM functionality hosted in that CPCM instance in accordance with the CPCM specification.

Compliance requires that the implementation of functionalities is additionally in accordance with the C&R Regime.

EXAMPLE 1: The security control element in a Compliant Device needs to be implemented in a manner that is conformant and additionally, in accordance with the compliance and robustness rules of the appropriate CPCM C&R Regime.

A CPCM Device can implement any of the CPCM methods to acquire input content from trusted sources, consume CPCM content at the device itself or via a compliant consumption output, or to export CPCM content in a conformant manner. The security of these blocks of functionality comes inherently from the specification and by explicit requirements of a C&R Regime.

The C&R Regime will place other requirements on the implementation.

EXAMPLE 2: The Processing Entity in a Compliant Device performs the CPCM function of processing which is permitted by the C&R Regime, such as video transformation performed upon CPCM content.

If CPCM content is exported to, or acquired from, a trusted CPS as requested by CPCM interaction and as possibly authorised by the content licence, a mapping has to take place. This mapping is done in accordance with the rules of the C&R Regime.

Input interfaces, consumption outputs, and export interfaces, are governed by the respective trusted source, trusted CPS or controlled CPS. Their agreed usage will be detailed by a C&R Regime.

4.2 How the C&R Regime relates to the standard

Market adoption of a content protection standard has two facets. One facet is the standard itself which describes the technical operation of the system. Conformance with the standard ensures the correct operation of a device and interoperability with other devices that implement the standard.

The second facet is the requirement that a device provide adequate protection for a particular class of content. This requirement is achieved by compliance with the requirements of a Compliance and Robustness Regime (C&R Regime).

Different C&R Regimes may require different levels of tamper resistance; from none, to state-of-the-art security. Most C&R Regimes are a compromise between the needs of stakeholders that provide content, stakeholders that provide devices, and consumers of the content.

All the normative parts of this specification (TSs) can be implemented without constraints as is normal with ETSI standards. An implementer may construct devices as they see fit within the requirements of the normative parts of the standard and can implement the normative parts of the specification according to its own self-certification rules necessary for conformance. There is no requirement for an implementer to conform to a C&R Regime other than the implementers own desire to ensure that certain classes of content are available to the device. Achievement of conformance will, in some cases, be considered sufficient for the purposes of content protection in some circumstances.

In many cases, however, such as a Pay-TV service, it may be necessary that an Acquisition Point adheres to the requirements of a specified C&R Regime, or regimes, before permitting delivery of content into CPCM. Furthermore, the Pay-TV operator may also desire to ensure that content is only passed from the Acquisition Point device to other devices which themselves adhere to the requirements of a C&R Regime and is authorised for that content. This obligation may likewise continue to other downstream devices up to and including the output or export of the content. Thus the implementer of the Acquisition Point and of the other devices in the content chain may elect to comply with the C&R Regime(s) authorised by the Pay-TV operator to handle the content.

5 The role of a compliance body and C&R Regime

A compliance body develops licenses, operates and governs the use of a C&R Regime. With respect to licensing, it issues licences for compliant implementations and also licences any relevant C&R Regime IPR.

A compliance body selects a certificate authority and specifies the Root Authority that the certificate authority will use.

A C&R Regime defines compliance and robustness rules for the design, construction, operation and other aspects of Compliant Devices to ensure that the CPCM protections afforded to CPCM content by the Compliant Devices are not compromised.

A C&R Regime may include one or more rule sets, each setting out requirements for specific markets for CPCM content, such as "basic protection" and "higher value", or "Territory A", or to respond to alternative implementation strategies.

EXAMPLE 1: An alternative implementation strategy may be a software implementation on general purpose computing platforms such as personal computers, or a hardware implementation involving software implementations in closed hardware systems such as a "system on a chip".

In the formulation of a rule set a compliance body may seek the views of other stakeholders in markets for CPCM Content.

The C&R Regime mandates relevant testing and/or validation procedures.

EXAMPLE 2: Testing and validation procedures by self-certification, or the use of third party testing facilities authorised by the C&R Regime.

Table 1: Required components of a C&R Regime

Component	Description
Certificate Issuance	Issuance of instance certificates and signing certificates.
External Mapping	1) The mapping of an external trusted, non-CPCM content protection system (CPS), to CPCM, for the import/export from such a CPS. The external CPS will have a complimentary set of mappings for devices licensed by that CPS. 2) The mapping between one CPCM C&R Regime and another CPCM C&R Regime.
External Mapping Enforcement	Provides a mechanism by which a compliance body can enforce the mapping of an external trusted non- CPCM CPS to CPCM to enable the export and import of content.
Usage Rules	Defines the settings of CPCM Usage State Information (USI) at the Acquisition Point input, Consumption Point output, export interfaces and within a Storage Entity.
Transient Storage	Defines the duration of transient buffers for copy, movement control and conversion.
Approved and Required Extensions	Defines any extension to CPCM baseline functionality, which may be proprietary or a DVB standardised solution that may be used or are required for operation under the C&R Regime.
Revocation	Provides the management of the agreed path to revocation, the issuance of revocation lists, and the application of revocation lists in trust establishment.
Interoperability with other C&R Regimes	Ensures interoperability based on mutual agreement between a C&R Regime and others including others using a different RA.
Authorised Domain Management	Defines the parameters and methods under a C&R Regime for managing an AD within a unique household.
Network Proximity Tools	The parameters for the mandatory proximity tools, as defined in TS 102 825-4 [i.8], in a home network or intranet environment.
Secure Relative Time	Minimal functionalities, such a minimal duration to support, and security constraints on secure relative time implementation.
Random number generator	Randomness and implementation constraints on the random number generator.

Table 2: Optional components of a C&R Regime

Component	Description
Content Transformation	The kind of transformation that is allowed through CPCM processing, such as trans-coding, AV effects, extraction of still images.
Certificate Issuance Regime	The regime for the issuance of certificates for the establishment of trust. (See note 1.)
Content License protection robustness	Describes the robustness from attack for the protection of the content license.
Crypto Periods	Establishes the duration of crypto periods or a maximum crypto period.
Content Key Management	The rules for managing content keys during content re-scrambling which may be necessary for any purpose.
Secure Absolute Time	The mechanism by which secure absolute time is implemented. (See note 2.)
Network Proximity Tools	The optional proximity tools and their parameters, as additionally defined by a C&R Regime, in a home network or intranet environment.
NOTE 1: This is different from the certificate issuance that the C&R Regime provides since the certificate issuance regime administers the issuance of certificates, whereas the issuance may be accomplished entirely through a third party.	
NOTE 2: Implementation under TS 102 825-4 [i.8] is optional but it may be required for a Compliant Device.	

5.1 Steps for a device to achieve compliance

First the implementer, or manufacturer as is appropriate, ensures that the device conforms to the CPCM specification; this step is usually accomplished by self-certification. Next, the implementer determines that the device meets the requirements of the particular C&R Regime(s) to which the implementer wishes to comply. These requirements include the compliance and robustness rules.

The implementer then follows the procedure required by the C&R Regime to certify that the device is a Compliant Device. This process might be the following:

- Submission of the device to the compliance body or an authorised test facility for compliance testing and certification.
- Self-certification of compliance by the implementer.

NOTE: Self-certification of compliance may be augmented by a compliance checklist and a declaration of compliance by the implementer.

Assuming the manufacturer and the device complies with all other license requirements set forth by a compliance body, a manufacturer whose device has successfully completed compliance testing is entitled to incorporate a certificate, issued by a certificate authority, in that particular device. A Compliant Device is a device satisfying one or more rule sets.

Typically a C&R Regime will have rules as to when changes in product design require re-certification of compliance.

5.2 Certificate authorities

Certificate authorities are entities which issue certificates to manufacturers pursuant to an agreement with a compliance body for a given C&R Regime. These certificates can be embedded into Compliant Devices or used to issue other certificates. Under certain circumstances, defined by the compliance body and at the direction of the compliance body, certificates issued by a certificate authority or by an intermediate certificate authority may be revoked.

The relationship between the Root Authority, the compliance body, and the certificate authorities is:

- A single Root Authority is able to certify any number of certificate authorities.
- Each certificate authority is designated by one or more compliance bodies.
- Each compliance body designates at least one certificate authority for its C&R Regime

- There cannot be more than eight C&R Regimes per Root Authority.
- Each certificate authority can be authorised by any number of Root Authorities.

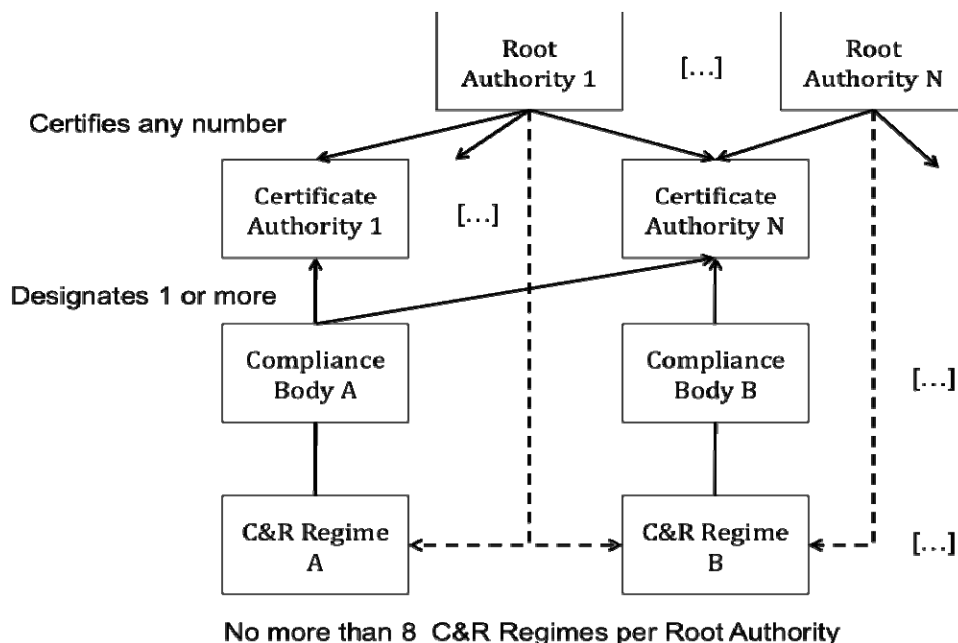


Figure 2: Relation to Root Authority

The compliance body defines the conditions under which:

- The certificate authorities may issue signing or instance certificates.
- The certificate issued by one of its appointed certificate authority will be revoked.

Each compliance body is responsible for defining its own compliance and robustness rules and revocation policy and for issuing revocation lists, if applicable. If used, revocation lists will be protected by the Root Authority by a revocation certificate provided by the Root Authority to the compliance body.

6 The CPCM trust model

The CPCM trust model is the framework of technical, contractual and other legal arrangements that establishes confidence in the adequacy of the protection of CPCM content and in the interoperability between Compliant Devices.

The trust model comprises, among other things, the establishment of the Root Authority and the certificate authorities, the functioning of the compliance bodies, compliance testing of devices, and embedding of certificates in Compliant Devices. A CPCM trust model addresses both the CPCM specification and CPCM extensions.

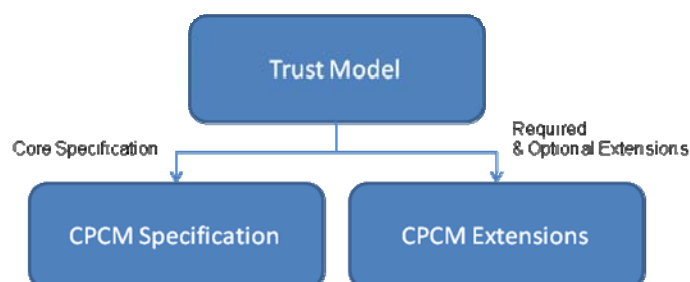


Figure 3: Elements of the CPCM trust model

6.1 The entities involved in the trust model

A Compliant Device needs to adhere to the trust model in order to enable authorised usage of CPCM content protected under the relevant C&R Regime. By comparison, interoperability between CPCM conformant devices is required so that they can communicate and transfer content.

The starting point for the CPCM system trust model is a root of trust which is typically the compliance body; that is, the licensing authority for the particular C&R Regime. The contractual terms, including the C&R rules defined for that C&R Regime, are administered by the compliance body thus establishing this root of trust.

Compliance rules and robustness rules defined by the C&R Regime need to be commercially acceptable to stakeholders as determined by that entity. As examples, a set of rules that provide no protection against circumvention may not be acceptable to the majority of content providers whereas a set of rules that require state of the art device security may not be acceptable to any more than a handful of device manufacturers.

A Root Authority is the single entity responsible for issuing certificates to entities qualifying as certificate authorities.

Certificate authorities are entities which issue, directly or indirectly, certificates to manufacturers for embedding into Compliant Devices.

A compliance body is an entity which defines and enforces a compliance and robustness regime; it is typically the same body as the C&R Regime owner.

Once established, the trust model operates as follows as is depicted in figure 4:

- 1) The Root Authority has been formed.
- 2) The Root Authority has issued certificates to certificate authorities.
- 3) One or more compliance bodies are formed.
- 4) Each compliance body develops and/or adopts a C&R Regime.
- 5) A manufacturer submits its product to a compliance body, or its designee, for any requisite compliance testing. This step may be accomplished by self-certification if permitted by the compliance body.
- 6) Once it has been determined that the product satisfies the requirements of the relevant C&R Regime; the compliance body notifies the appropriate certificate authority.
- 7) The certificate authority issues a certificate to the manufacturer for embedding into the Compliant Device.

The exact means by which certificates are issued and how they are embedded in the Compliant Device is determined by the compliance body for the C&R Regime.

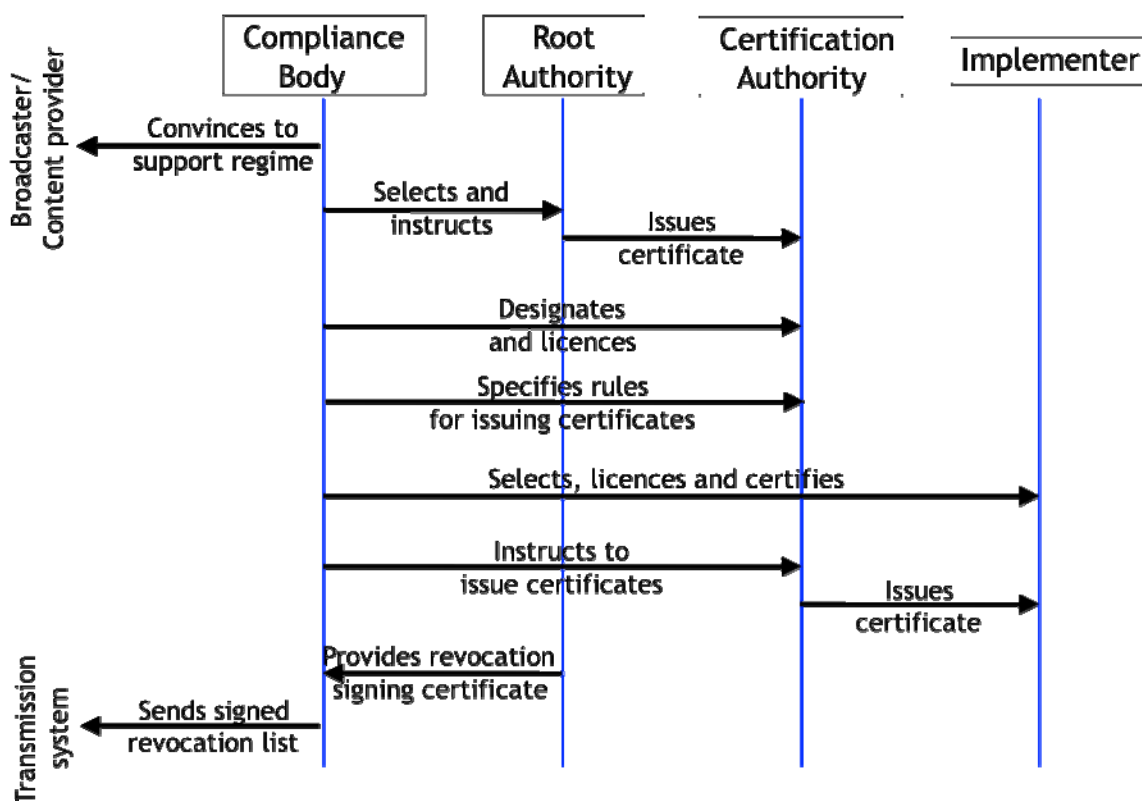


Figure 4: Interactions between the entities

6.1.1 Root Authority

The Root Authority is the entity responsible for issuing certificates to entities qualifying as certificate authorities. The Root Authority can be formed by an industry consortium or can be a designated business operation.

A compliance body will select a Root Authority for use by its certificate authority or certificate authorities.

6.1.2 Compliance rules

The compliance rules define the required behaviour or characteristics of a CPCM Compliant Device with respect to the implementation of the CPCM specification and any other requirements set forth by the Compliance Body.

EXAMPLE: Compliance rules may include:

- requirements to follow usage rules contained in copy control information associated with the content;
- requirements to use approved protected outputs;
- requirements to use approved protected recording technologies in those instances where consumer copying is permitted.

6.1.2.1 Inherent compliance

Inherent Compliance is where a CPCM device by virtue of its construction meets the C&R Regime requirements for baseline functions.

EXAMPLE: All-in-one CPCM devices which are not able to interconnect with other CPCM devices.

6.1.3 Robustness rules

CPCM implementations, and/or components as licensed by a particular compliance body, need to meet the applicable robustness rules defined by that entity. Robustness rules typically specify; the level of resistance to circumvention attempts, requirements to protect the secrecy of keys, requirements to prevent compressed content from being available on user accessible buses in the clear.

6.2 CPCM extensions and private extensions

Any extension functions are optional and CPCM devices are required to have these functions only to process content that requires the function. Whatever functionality they implement, extensions are still subject to the CPCM C&R Regime. Particular extensions may be required under a C&R Regime to meet the requirements to process content protected under that C&R Regime. Alternatively, a C&R Regime may decide to refuse the support of an extension, in which case the usage of the extension will not be permitted when handling content protected by that C&R regime.

Alternatively, a C&R Regime may decide to refuse the support of a CPCM or a private extension, in which case the implementation of the extension may be incompatible with the compliance to that C&R regime.

6.2.1 Compliance body

The certificate authority issues certificates for the extension for use in CPCM compliant devices at the direction of the compliance body. It is possible for a compliance body to be established only for CPCM extensions.

It is also possible for an extension to use the certificate of a CPCM instance. In this case, the delivery of the certificate is conditioned by the compliance of the CPCM instance and the extension. Trust between the CPCM instance and the extension is established by inherent compliance such as implementation in the same hardware.

6.2.2 Compliance rules

The compliance rules for extensions define the required behaviour or characteristics of a CPCM trusted device with respect to the optional extension functions. CPCM Devices are only required to meet these compliance rules if they are to process content that requires the function.

6.2.2.1 Inherent compliance

Inherent compliance is where a CPCM device by virtue of its construction meets the CPCM compliance rules for controlled CPCM extensions.

6.2.3 Robustness rules

The robustness rules for extensions apply to the plug-in or extended functionality.

6.3 C&R Regime enforcement

The purpose of a C&R Regime is to ensure protection of CPCM content in accordance with its authorised usage. A compliance body will have means to uniformly enforce its C&R rules across all implementations which it licences in order to ensure that device manufacturers who decide to build products licensed under the C&R Regime are not disadvantaged by inconsistent enforcement of the C&R rules. This may be achieved by both:

- 1) issuing licenses to use C&R Regime IPR and enforcing the terms and conditions against licensees that do not fully adhere to their obligations;
- 2) requiring the taking of a license to use C&R Regime IPR and enforcing against non-licensees that use such IPR without a license.

The term C&R Regime IPR refers to the IPR which lies outside of the CPCM specification and is licensed by the compliance body. This IPR ensures that obligations associated with the C&R Regime are totally voluntary and are separate from the CPCM specification. Employing C&R Regime IPR enables a variety of business arrangements to operate independently of one another. It allows content owners and device manufacturers to choose which arrangements best suit their business needs, and to license only those C&R Regimes which are of interest to them without having to assume obligations required for other regimes. C&R Regime IPR is separate from essential IPR and therefore does not interfere with the licensing of the essential IPR and the implementation of the CPCM specification.

Use of particular C&R Regime IPR licensed by a given compliance body is therefore necessary to gain access to the content protected under that C&R Regime. A compliance body needs a means of enforcement against third parties that seek access to its protected content without taking a license or assuming the associated obligations. Enforcement is important to content providers, and to device manufacturers to ensure that only those manufacturers who have elected to build compliant devices assume the obligations and obtain the benefits of entering into the license arrangement.

The choice to use C&R Regime IPR is a decision for the compliance body.

In addition to allowing potential licensees to choose which C&R Regimes best suit their business needs, C&R Regime IPR also provides a legal means of pursuing unlicensed third parties through patent infringement.

6.4 The chain of trust

Content protection and copy management is a key component in the chain of trust that flows from the content creator to the content consumer. This chain of trust allows a viable arrangement, whether commercial or otherwise, that facilitates the delivery of content in a way that is satisfactory to all stakeholders.

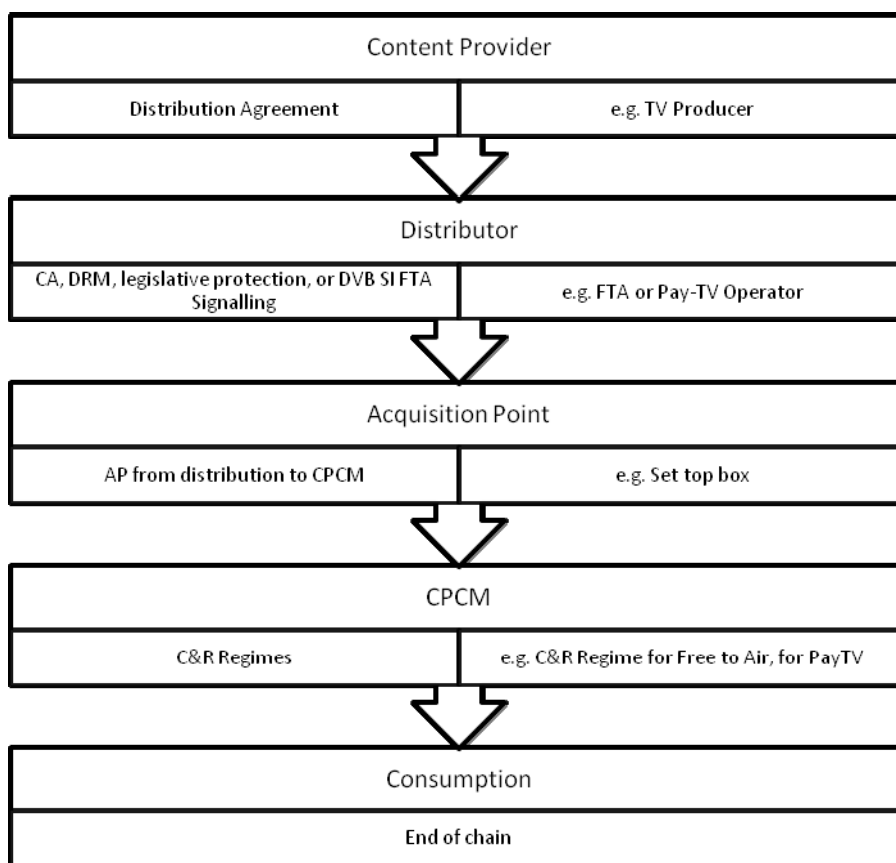


Figure 5: Example of a chain of trust

The principle of the chain of trust is that each entity passes the content on to the next entity subject to a particular trust element. In the example the content provider uses the distribution agreement as a way of trusting the distributor. In the case of Pay-TV the distribution requirement requires the distributor to use either a DRM or conditional access system and, in the case of FTA, the content_management_descriptor as defined in EN 300 468 [i.14].

For Pay-TV, in addition to protecting the content, the use of a DRM or conditional access system provides a way of transferring trust through the CA provider requirements to the Acquisition Point. The Acquisition Point is contained within the set top box and the set top box manufacturer has to comply with the requirements of the CA provider as these requirements oblige the use of CPCM with a particular or anyone of several C&R Regimes.

Free-to-air content is traditionally distributed in the clear and can be received by any device capable of decoding the transmission. In these circumstances, a chain of trust can be established by legislative protection and/or establishment by a compliance body of requirements to implement an approved content protection system by receiver manufacturers.

6.5 C&R Regime interoperability

Interoperability in content protection systems has two meanings:

- Interoperability between devices means that they are technically conformant so that they are able to communicate and exchange content.
- Interoperability between C&R Regime's means that devices constructed to meet one C&R Regime are authorised to communicate and exchange content with devices constructed to meet another C&R Regime when that communication involves the exchange of content that is the subject of both C&R Regimes.

Thus in the Pay-TV operator case the Acquisition Point device and the downstream device have to be interoperable in both senses to allow the Pay-TV operator's content to flow from one to the other. The two devices have to conform to the standard so that they know how to exchange any content, and they need to be interoperable between both C&R Regimes, or operate under the same, C&R Regime so that they are permitted to exchange the Pay-TV operator's content.

The CPCM system provides for up to eight different C&R Regimes to share the same Root Authority (RA) and be interoperable.

Any compliance body can select the Root Authority (RA) it wants to use although there can only be a maximum of eight C&R Regimes under a particular RA. A common RA between C&R Regimes is based on an agreement between the compliance bodies that want to interoperate under that RA.

In order to achieve interoperability with a C&R Regime under a different RA, the Compliant Device needs to know both RAs. This way, it will be able to verify the certificate of any Compliant Device of a C&R Regime under that RA and thus to proceed to trust establishment.

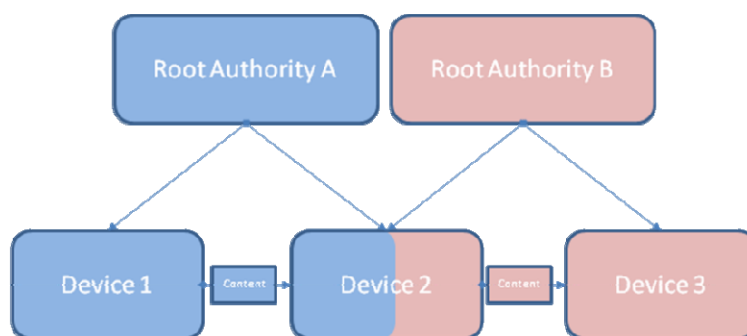


Figure 6: Different Root Authorities

There are a number of ways for content to pass from one C&R Regime to another.

EXAMPLES:

- Export from CPCM under one C&R Regime and re-acquisition into CPCM under another C&R Regime.
- Regeneration of the content licence by an authorised CPCM Instance. This may involve a change of usage rights as signalled by the resulting USI.
- Asserting at the first content Acquisition Point all the bits in the C&R Regime mask for all C&R Regimes authorised for that content, and creation of as many content licences as there are involved Root Authorities.

6.6 Root certificates

The means of issuance of root certificates is outside of the scope of the present document other than to say that this is done through an application to the Root Authority that issues root certificates. The qualification of applicant certificate authorities is the responsibility of that Root Authority. The compliance body requires that its certificate authority use a particular Root Authority, so the compliance body needs to ensure that the means of issuance exists to establish the root of trust for its C&R Regime.

7 CPCM functions and compliance

CPCM does not exist in an isolated world. Consequently it is necessary to interoperate with external content handling systems. Input and output to/from non-CPCM systems falls into three categories illustrated in the following diagram.

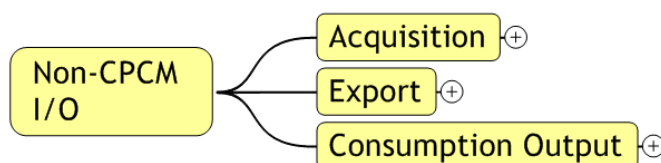


Figure 7: Elements of non-CPCM I/O

The CPCM content paths need to adhere to the CPCM compliance and robustness requirements of the CPCM C&R Regime.

7.1 Acquisition

Acquisition is the receipt and ingestion of content that was outside the CPCM system into the CPCM system.



Figure 8: Elements of acquisition

Content flows into CPCM through the Acquisition Point. For the compliance framework there are two aspects to the acquisition of content:

- 1) Whether the source of the content trusts a CPCM device licensed under a particular C&R Regime.
- 2) Whether the source of the content is a trusted source by the rules of a particular C&R Regime.

The first aspect is a direct consequence of CPCM's place in the chain of trust. If the source of the content trusts CPCM devices implemented under a particular C&R Regime then content can be acquired by the Acquisition Point.

The second aspect comes about because CPCM is designed to protect a certain class or classes of content but not including the user's own content such as their home movies. A C&R Regime thus excludes the user's own content from being protected within the realm of protection of that C&R Regime. This condition is necessary for the chain of trust to extend to the C&R Regime. It prevents ingest of unauthorised content into the protected system. By preventing this, measures outside of the scope of the CPCM specification can be used to distinguish between pirated content and home movies. If unauthorised content does flow into the protected system, and thus falls into the realm of protection of the C&R Regime, it is difficult to distinguish unauthorised content from legitimate content. Thus it is clear that only acquisition from a trusted source should occur.

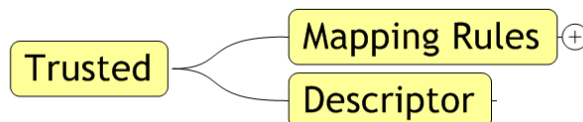


Figure 9: Elements of trusted acquisition

Acquisition of content from a trusted source includes mapping rules and the use of a descriptor. The mapping rules are part of the compliance rules of the C&R Regime. These rules address how the USI for the content in the external CPS maps to CPCM USI. The rules are in part descriptive of the technical mapping, such as "this state maps to this state", and are in part a result of the agreement between stakeholders that led to the adoption of the C&R Regime which may include encoding rules.

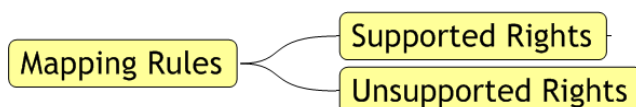


Figure 10: Elements of mapping rules

The mapping rules break down further into those rights expressed in the USI for the upstream or source CPS that can be mapped into the CPCM USI, and those rights that cannot be mapped into the CPCM USI. How unsupported rights are handled will be a matter for the compliance rules which could require the content to be rejected or the unsupported rights to be transferred with the content by a mechanism outside of the scope of CPCM.

The CPCM system only acquires content for which there is an approved usage rule mapping, such as from a trusted source that includes usage rule signalling known to and trusted by CPCM as set forth in the C&R Regime.

Such mappings may be specified either as an open standard, or as part of a mutual agreement between a CPCM deployment or C&R Regime, and the regime for the other system to which, or from which, CPCM is mapped.

The C&R Regime will enumerate trusted acquisition sources and define mapping rules.

7.1.1 FTA control signalling

- The mapping of FTA control signalling into CPCM USI is extensively defined in TS 102 825-10 [i.5], except for one setting of `control_remote_access_over_internet`.
- The C&R Regime has the option to redefine the duration after which the content can be made remotely accessible within the AD when `control_remote_access_over_internet` is set to 3, in which case remote access is prohibited except after a long period of time and from within the AD.

7.1.2 Trusted acquisition

Trusted acquisition is from a system or entity which is able to provide input content for the CPCM system on the grounds of explicit approval of that system or entity and/or its compliance with the CPCM compliance specification.

Table 3: Rules for trusted acquisition

Topic	Rules
Mapping Rules	The mapping rules define how the rights defined within the trusted acquisition system are mapped to the CPCM USI.
Supported rights	The supported rights are the subset of rights defined within the trusted acquisition system that can be represented in CPCM USI.
Unsupported rights	The unsupported rights are the subset of rights defined within the trusted acquisition system that cannot be represented in CPCM USI.
Descriptor	This describes the particular technology including major version information.

7.1.3 Integration with conditional access (CA) systems

An Acquisition Point may be integrated with a CA system into a single device such as set-top box. Content delivered to the set-top box is protected by the CA and acquired into CPCM by the Acquisition Point. From a C&R Regime point of view, such a device represents the transition from the device manufacturer's obligations as a result of being an implementer of the CA system to the device manufacturer's obligations as a result of being a licensee of the C&R Regime. Referring back to the chain of trust diagram, figure 5, this is the transition from one "link" of the chain to the next.

The CA system is the supplier of the content, the information from which the USI is mapped, and the deliverer of revocation lists.

7.2 Processing

Processing in the context of CPCM is a CPCM conformant operation upon CPCM protected content, or authorised usage of CPCM protected content, whereby the CPCM protected content and/or the content licence undergo a permitted transformation from its original form to create new CPCM protected content.

Such processing may be defined by the C&R Regime as to which of it is allowed generally, or it could be stipulated that some processing is only allowed in conjunction with Copy Control Information USI states. The definitive rules should be stated by the CPCM C&R Regime.

If the Processing Entity is used to change the resolution or level of compression of an item of CPCM content, such as, decreasing the resolution for a mobile device, then the C&R Regime compliance rules will state the required changes to the licence, if any, for the new CPCM content. This compliance rule should address the following:

- Whether the new CPCM content gets a new content licence or if the original content license is transferred.
- How, if at all, the original CPCM content can be recovered or if the CPCM content is permanently converted to the new format.

The C&R Regime may need to define a CPCM extension using usage rule signalling that is contained within a content licence. This would be used to signal, on a per content item basis, whether or not certain processing is allowed.

EXAMPLE: Image constraint where processing control is contained within the CPCM specification. In this case certain specific processing is required for content that includes this USI signal before it can be output to an analogue or un-trusted digital interface.

7.3 Export

Export is the release of CPCM content from explicit protection and management by the CPCM system. The compliance rules from the C&R Regime determine when content can be exported.

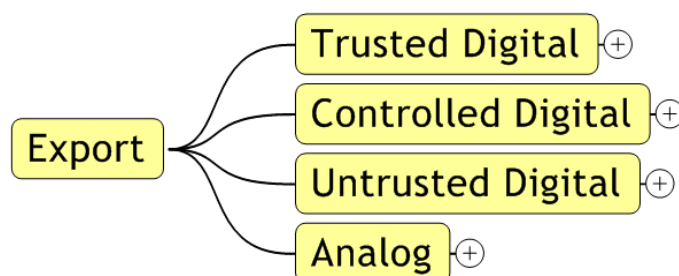


Figure 11: Elements of export

Standardized specifications of both physical interfaces for the transmission of exported content at device outputs, and storage formats for the carriage of exported content are contained in TS 102 825-10 [i.5]. Mapping rules will be defined for all classes of export. The mapping rules will enumerate supported USI and unsupported USI states for each form of export.

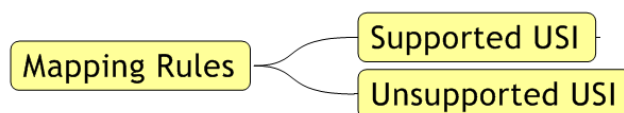


Figure 12: Mapping rules for export

The C&R Regime specifies how a CPCM instance in a Compliant Device that exports CPCM content to another CPS maps certain fields of the content license and/or CPCM auxiliary data to the format; that is, the syntax and semantics, of the external CPS.

The C&R Regime also specifies the behaviour of the export Point with regard to permitted actions.

7.3.1 Trusted digital export

Export to a trusted digital output means that the C&R Regime establishes universal trust with the CPS to which CPCM will export protected content. This typically happens when the destination CPS offers comparable levels of protection to CPCM as established by the CPCM compliance body and the compliance body for the receiving CPS.

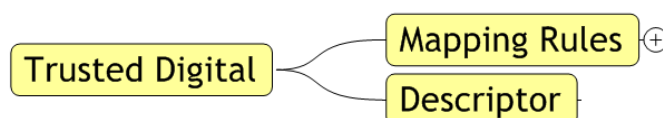


Figure 13: Trusted digital export

A trusted digital system is a trusted third-party content protection system with which a predetermined set of CPCM interoperability rules, including a USI mapping, has been defined and approved by a CPCM compliance body. It is expected that the compliance body licensing the CPCM C&R Regime will reach a legally binding agreement with the compliance body of the third party content protection system.

Export to a trusted digital output cannot be selected by the USI. It is agreed a priori when the two compliance bodies reach agreement. Content can be prevented from being passed to a trusted digital system only by de-listing the system as an approved output for CPCM under a particular C&R Regime.

"Trust" implies that both the technology as well as the compliance and robustness rules of the receiving system is trusted.

Trusted Export (C.3.1) is a digital output to a trusted CPS for which there is a defined USI mapping, with no explicit control of the output by means of USI signalling for CPCM content transferred to that trusted CPS. The CPSs included under trusted export will be defined in the CPCM C&R Regime.

Table 4: Rules for trusted digital export

Topic	Rules
Mapping Rules	The mapping rules define how the USI and other information bound to the content is mapped from its CPCM representation to the representation in the trusted CPS.
Supported USI	The supported USI is the subset of CPCM USI that is supported by, and can be mapped to, predefined states in the trusted CPS. This requires a fixed mapping to be defined by the C&R Regime.
Unsupported USI	Unsupported USI is the subset of CPCM USI that is undefined by the trusted CPS and which cannot be mapped to any states in the trusted CPS.
Descriptor	This describes the particular technology including major version information.

Universal trust does not necessarily mean that any piece of content can be passed to a trusted CPS. There might be restrictions based on a dedicated USI setting, involving, for instance, unsupported USI in the trusted CPS. Some examples are shown in table 5.

Table 5: Examples where export to a trusted CPS might be denied

Circumstance	Control Factor
Particular USI states cannot be mapped to the USI of the external CPS. For example, external CPS does not have a proximity mechanism	Export of content that does not have proximity controls is permitted, export of content that has proximity controls is not permitted.
The external CPS permits content to be exported to uncontrolled analogue outputs	If the content cannot be exported from CPCM by an analogue output then logically it cannot be exported to an external CPS that in turn allows export by an analogue output.
The external CPS trusts CPCM and some of its trusted inputs, but not all of them	If the content carries in its auxiliary data the evidence it originates from one of the input trusted by the external CPS, export is granted.

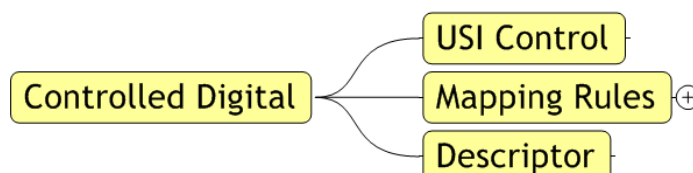
The C&R Regime enumerates the external content protection systems that are trusted exports and defines mapping rules to those systems. The C&R Regime may define a process by which an external content protection system can be removed from the enumerated list, to those classes of content for which such delisting applies. This would be the case when content acquired after the external content protection system was removed from the enumerated list, and whether or not the external content protection system becomes a controlled CPS.

Delisting a trusted CPS at a given time applies only to CPCM implementations licensed from that time forward.

7.3.2 Controlled digital export

A controlled CPS is an externally defined or proprietary content protection system that is an authorised output on any CPCM device but can only be used if authorised in the USI signalling. Content can be prevented from being passed to a controlled CPS by settings in the USI.

Export to a controlled CPS means that the compliance body trusts the destination content protection system under certain circumstances. In some cases, a controlled CPS technology or system may be viewed to offer less protection than CPCM, at least for certain content. In other cases, the compliance body may wish to retain a looser coupling of its C&R Regime with the content protection system to which export is intended. This is in order to isolate breaches or changes in one content protection system from the other content protection system.

**Figure 14: Controlled digital export**

An example of when a C&R Regime may conditionally allow export through a controlled digital output is described below:

Table 6: Example of Export through a controlled digital output

Circumstance	Control Factor
Destination CPS offers less robust protection. For example it uses an encryption algorithm that is known to have been compromised.	Resolution of content: Export of standard definition content is permitted; export of high definition is not permitted.

Controlled export/output subsumes both export to a controlled CPS and output to a digital consumption output secured by a controlled CPS. The C&R Regime describes the circumstances when an output control usage rule is used to enable, disable or constrain particular CPCM Device outputs for particular types of CPCM content. The output control usage rule is applied as a result of the C&R Regime compliance rules to outputs used for export.

Controlled export (C.3.2) is the digital output of CPCM content mapped to a trusted CPS under the explicit control of the output control usage rule assertion carried within the USI for that CPCM content. The trusted CPSs included under controlled export will be defined by the CPCM C&R Regime.

A controlled CPS is a trusted CPS to which export or output can be enabled and disabled subject to specific USI. In any of the four topics of content leaving CPCM, listed in table 7, the USI will be mapped to a predefined state of usage state information within that trusted CPS or controlled CPS. Export/output to a trusted CPS is not governed by a dedicated USI field but by a C&R Regime while export/output to controlled CPS is governed by both a dedicated USI field and the relevant C&R Regime.

Table 7: Rules for controlled digital export

Topic	Rules
Mapping Rules	The mapping rules define how the USI and other information bound to the content is mapped from its CPCM representation to the representation in the controlled CPS.
Supported USI	The supported USI is the subset of CPCM USI that is supported in or which can be mapped to predefined states in the controlled CPS. This requires a fixed mapping to be defined by the C&R Regime.
Unsupported USI	The unsupported USI is the subset of CPCM USI that is undefined in, and which cannot be mapped to, any states in the controlled CPS.
Descriptor	This identifies the particular technology, including major version information.

The C&R Regime enumerates the external CPSs that are controlled CPSs for export, defines USI control and defines mapping rules. To enable USI control the C&R Regime assigns, a bit in the Control CPS Vector to each external CPS at the time of acquisition of CPCM content.

7.3.3 Un-trusted digital export

An un-trusted digital system is any system, entity, device, component, medium, function, interface or any other tangible or intangible thing other than the CPCM system and all trusted CPSs. Export to an un-trusted digital output means that, under the compliance rules of the C&R Regime, a particular piece of content can be exported through a digital output without there being a requirement for a trusted CPS to be applied. This might mean that there is no CPS or it might mean that there is a CPS but no trust, either mutual between the systems or of the external CPS compliance body, by the CPCM compliance body.

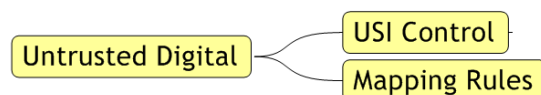


Figure 15: Un-trusted digital export

Table 8: Rules for Un-trusted digital export

Topic	Rules
Mapping Rules	The mapping rules define how the USI and other information bound to the content is mapped from its CPCM representation to the representation in the un-trusted digital system.
USI Control	The USI signals whether or not a CPCM device is permitted to pass content to an un-trusted digital output.

At the time of acquisition of CPCM content the C&R Regime defines the conditions under which un-trusted digital outputs can be used, define required content protection signalling methods that are supported, and define USI control and mapping rules.

7.3.4 Analogue export

Within the chain of trust analogue outputs are always un-trusted. This is evident because trust in a content protection system is typically maintained by encrypting content, the binding of a certificate to the content, or some such cryptographic means. This is something that is not possible with analogue signals.

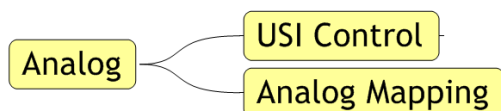


Figure 16: Analogue export

Table 9: Rules for analogue export

Topic	Rules
Mapping Rules	Primary mapping rules are defined in TS 102 825-10 [i.5]. Additional mappings may be defined by the C&R Regime.
USI Control	The USI signals, whether or not a CPCM device is permitted to pass content to an analogue output.

At the time of acquisition of CPCM Content, the C&R Regime mapping rules will define the conditions under which analogue outputs can be used, define required content protection signalling methods that are supported, define USI control and mapping rules.

7.4 Consumption

A consumption output (C.2.2) is an output at a digital (C.2.2.1) or analogue (C.2.2.2) device interface, containing a transformation or signal that is intended to inhibit any other function than immediate consumption of that content that is to inhibit storage of that content. The method of transformation or signalling that depends on the specific interface is set as part of the C&R Regime compliance rules.

The C&R Regime may require compliant devices to control a C.2.2 consumption output. Such control could constitute down-resolution of the image or even turning off the consumption output altogether. Other controls can be implemented using CPCM extensions defined or selected by the compliance body.

Standardised specifications of physical interfaces for the carriage of consumed content at device outputs are contained in TS 102 825-10 [i.5]. Such mappings can also be defined by the C&R Regime. Some examples of how a C&R Regime might distinguish between consumption and export are:

- consumption is marked as "Copy Never" as this is a special case of export;
- consumption uses outputs that are only applicable to consumption-only devices such as video displays;
- consumption is to external CPSs that do not permit content to be recorded;
- consumption through an analogue output invokes an analogue copy protection technology.

A C&R Regime will need to ensure that a CPCM instance that outputs a CPCM content item to a consumption output maps certain fields of the content licence and/or CPCM auxiliary data to respective fields of the other CPS.

7.4.1 Digital consumption

The output control usage rule provides the ability to enable, disable, or constrain particular CPCM Device outputs for particular types of CPCM content. The output control usage rule is applied as a result of the C&R Regime compliance rules to outputs used for consumption.

There are three types of digital consumption:

- Direct consumption by a CPCM instance, such as a plasma television with a built-in CPCM Consumption Point that descrambles CPCM Content and sends it robustly to the internal display elements.
- Output of content items to a digital consumption output secured by a trusted CPS.
- Enabling or disabling of the output of content items to a digital consumption output is secured by a controlled CPS.

Table 10: Rules for digital consumption

Topic	Rules
Mapping Rules	The mapping rules define how the USI and other information bound to the content is mapped from its CPCM representation to the representation in a controlled CPS or trusted CPS. Digital output for consumption may need to be marked "Copy Never" or "Copy No More" for a controlled or trusted CPS that does not support a consumption-only function through other means. Image constraint, though not applied to controlled and trusted export, is another USI field that may be used in this mapping. All USI fields may impact this mapping.

7.4.2 Analogue consumption

The output control usage rule provides the ability to enable, disable or constrain particular CPCM Device outputs for particular types of CPCM content. The output control usage rule is applied as a result of the C&R Regime compliance rules to outputs used for consumption.

- ability to enable and disable the output on C.2.2.2 SD Analogue Consumption Outputs for standard definition video for content items of the types necessitating this control;
- ability to enable and disable the output on C.2.2.2 HD Analogue Consumption Outputs for high definition video for content items of the types necessitating this control; and
- ability to ensure that, if image constraint is signalled, a content item is passed through a processing function that constrains the resolution of that content item prior to output of that content item on analogue consumption and export outputs. The constraining function is to be in accordance with the parameters specified in TS 102 825-3 [i.6].

Table 11: Rules for analogue consumption

Topic	Rules
Mapping Rules	Analogue output for consumption is marked "Copy Never" or "Copy No More". It is not the intent to enable new analogue use cases.
USI Control	The USI signals whether or not a CPCM device is permitted to pass content to an analogue output.
EXAMPLES	Regarding Mapping Rules: <ul style="list-style-type: none"> • A Pay-TV set-top-box might turn on and off SCART pass through mode, or turn on an analogue protection system such as Macrovision or Dwight Cavendish, that would prevent recording but not display further down the chain. This will be controlled through the rights mapping. The intent here is enabling the current use cases and has them continue to work. • Watermarking can convey the usage rights.

7.5 Storage

Storage in a CPCM system performs the CPCM function of storage which is to store copies, of CPCM content. Physical storage drives can be embedded within a device or be external to a device, however they are always outside of the CPCM instance.

CPCM content on a drive or other physical media is always protected by CPCM, and it is the content licence function inside the security control part of the CPCM instance that keeps the CPCM content secure. Consequently, the C&R Regime will dictate the required robustness for protecting the content licence, rather than the content, on the assumption that protecting the content licence is easier than, and just as secure as any mechanism for preventing access to the protected CPCM content.

8 Security and compliance

Establishing mutual trust is the first step to secure transactions between any two devices. "trust" is the basis for the secure operation of CPCM security mechanisms. Trust establishment in the CPCM system comes out of a hierarchy of trust that flows from the Root Authority to the certificate authority and then down the tree structure defined by each certificate authority to the leaf certificates, i.e. CPCM instance certificates.

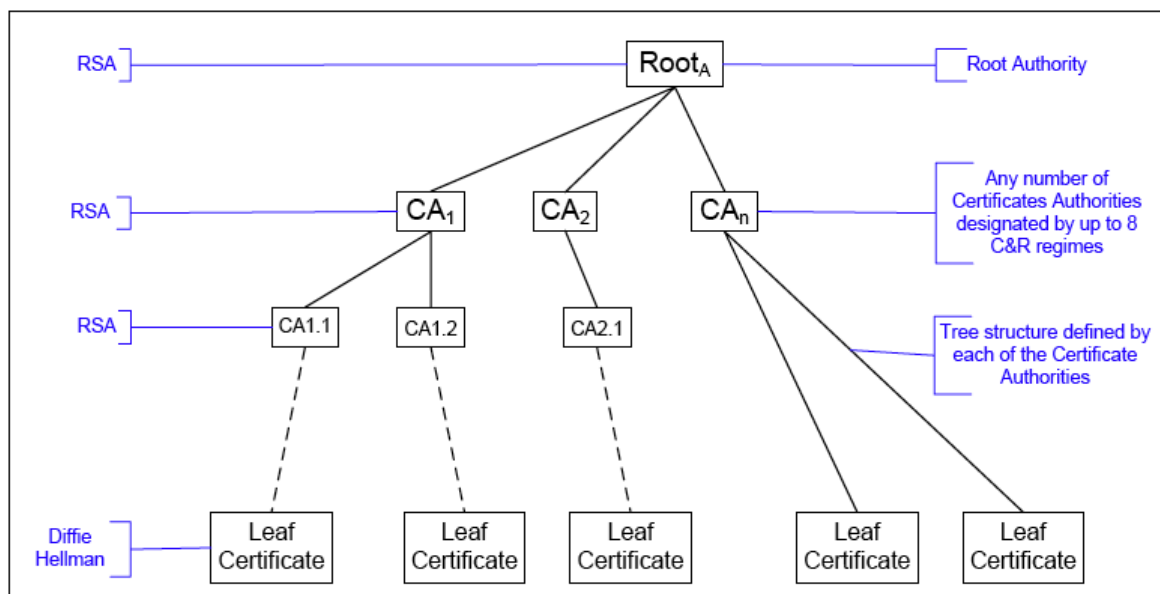


Figure 17: Trust hierarchy

At the topmost layer is the Root Authority, which is able to certify any number of certificate authorities designated by one or more of the up to eight CPCM C&R Regimes that can exist under the Root Authority.

The certificate authorities may issue signing certificates to other entities wishing to produce signing certificates or CPCM instance certificates subject to the C&R Regimes constraints. Thus entities, which are typically commercial, may choose to generate their own certificates.

EXAMPLE: A device manufacturer may structure its certificate hierarchy according to its multiple business units and product lines, as shown by the dotted line in figure 17 which indicates such an unspecified hierarchy.

In contrast, other commercial entities have the option to get their CPCM instance certificates from an outside certificate authority rather than generate their own CPCM instance certificate chain in-house, as shown by a direct line in figure 17.

All certificates, with the exception of the CPCM instance certificates, are signing certificates containing the RSA public key needed in the verification of its descendants. Signing certificates will also indicate for which C&R Regime or regimes they are valid by means of the setting of a bit or bits in an 8-bit C&R mask field preserved and expressed in the CPCM instance certificate.

Each C&R Regime is responsible for defining its own revocation policy, and issuing revocation lists. The revocation lists will be generated by the compliance body and signed using a dedicated key delivered by the Root Authority.

The common Root Authority enables two CPCM instances not implementing the same C&R Regime to trust each other under pre-determined circumstances.

8.1 Trust establishment

Trust establishment requires the following:

- Two devices each of which is compliant with a C&R Regime.
- Either trust between the two C&R Regimes or the devices share a mutual C&R Regime.
- Valid certificates issued to each device by the appropriate certificate authority.
- Conformance with the CPCM specifications.

Trust between two C&R could be limited.

EXAMPLE 1: Passing a CL is acceptable, but AD management is not acceptable.

Trust may be established for all or for only certain content licenses.

EXAMPLE 2: Content transfer from CPCM instance A to CPCM instance B.

Trust between instance A and Instance B requires that at least one of the C&R Regimes that A conforms to and for which B is not revoked trusts at least one of the C&R Regimes of B for the intended action such as ADM action or proximity check.

The Certificate of B and each revocation lists of the C&R Regimes that A conforms to are verified.

EXAMPLE 3: Content acquired by a CPCM device from a CA protected source which is a trusted source.

Trust between the trusted source and the CPCM instance acquiring the input content requires that the trusted source is compliant with the CA system C&R regime and the CPCM device is compliant with a CPCM C&R Regime.

Mutual trust needs then to exist between the CA system and the CPCM C&R Regime.

Exchange of content is permitted in the particular case. The CPCM C&R Regime is an approved output of the CA system.

8.1.1 Scrambling key period

The period for which the content scrambling key remains unchanged can be set by the C&R Regime. The key period may span several events, a single event, or a segment of a single event.

A C&R Regime may also impose a maximum duration of the content scrambling key. Different values may be set for Acquisition Point, Processing Entity, and Storage Entity.

In some cases the C&R Regime may even impose key change in a downstream content protection system to which CPCM Content has been exported.

A C&R Regime needs also to consider that some export or consumption technologies may be unable to support the selected key change period.

A C&R Regime may require the implementation of a subset of the available modes of the CPCM scrambler. However for interoperability reasons all modes of the CPCM de-scrambler should be implemented.

8.1.2 Secure authenticated channel (SAC)

Once established, the SAC is the mechanism by which one CPCM instance exchanges information with another CPCM instance.

A C&R Regime will need to specify the SAC expiration as well as the minimum time or operations before the SAC renewal can occur.

8.2 Secure absolute and secure relative time

The C&R Regime specifies:

- 1) Robustness of the secure absolute time and secure relative time implementation.
- 2) The source(s) of secure absolute time.

8.3 Random number generation

Random number generation is a tool used to achieve security. It is used in the SAC establishment procedure, to generate content scrambling keys and elsewhere. Having a random number generator with bad entropy, predictability, or vulnerability to modification could result in easy attacks upon CPCM.

Therefore, the C&R Regime is expected to define compliance and robustness rules for random number generation.

Examples of criteria to obtain a good random number generator can be found in TR 102 825-12 [i.7].

8.4 Content delivered in the clear

There are two ways a CPCM C&R Regime can handle content delivered in the clear.

The first and simplest situation is content is delivered in the clear to a CPCM instance by a trusted source without any assertion of the DNCS usage rule. The C&R Regime requires that the content be protected by the same mechanism as any other content managed under the C&R Regime. If a C&R Regime requires other content to be protected by scrambling then the clear content will be scrambled.

The second situation is where the DNCS usage rule is asserted. In this case, there is a requirement from the service provider to keep the content in the clear. In this case the C&R Regime defines how and to what extent the content will be protected by a means other than scrambling. It is outside the scope of the present document to describe how this might be accomplished.

The C&R Regime will define the duration of validity of a content licence bound to un-encrypted content.

NOTE: In the case of encrypted content, the duration of validity of the content licence is set by the change of content scrambling key.

Notwithstanding the assertion of the DNCS usage rule all other aspects of the CPCM security control, for example trust establishment and SAC management, can be managed by the C&R Regime.

8.5 CPCM content licence

The C&R Regime specifies several aspects of the content licence in order to determine specify content operations that are permitted and not permitted.

- The CPCM versions that are supported by a compliant CPCM instance.
- The robustness requirements of the content protection and whether an exception is permitted for CPCM content for which the `do_not_cpcm_scramble` bit is set in the USI.
- The setting of all or some of the fields of the CPCM Usage State Information (USI), the metadata that signals the authorised usage for each CPCM content item.

Authorised usage is reflected in the states set as a result of the mapping from the upstream delivery systems.

8.6 Usage State Information (USI)

Usage rules are the particular operations or behaviours that are within the scope of content protection and copy management and are to be controlled by the CPCM system through conformance with CPCM specifications and compliance with the C&R Regime. The possible set of usage rules will be established by the C&R Regime in accordance with the CPCM specifications. The C&R Regime compliance rules set the mapping between external representations of usage information and the values of the USI fields in the content licence.

NOTE: The mappings for FTA content management descriptor as defined in EN 300 468 [i.14] at a CPCM Acquisition Point to CPCM USI are defined in TS 102 825-10 [i.5].

8.7 Auxiliary data

Auxiliary data is carried in a private data structure that may be used to carry data unique to each C&R Regime or to a dedicated CPS. A C&R Regime can specify the use of the auxiliary data to transparently pass signalling from a trusted source to an external trusted or controlled CPS along with content that is exported or output to that external CPS.

The structure of the auxiliary data is the responsibility of the C&R Regime and may require harmonisation with other DVB specifications, other standards organisations and private entities.

A C&R Regime may define its own auxiliary data for its own purposes.

8.8 Encoding rules

Encoding rules define the limitations placed on content providers and/or service providers when setting USI and auxiliary data. The C&R Regime compliance rules may specify that certain values are set according to encoding rules that limit the setting of some states depending on the type of content.

NOTE: The original signalling used to generate the USI that is retained within the auxiliary data may be used in addition to the CPCM USI to ensure the best possible mapping.

EXAMPLE: Content received as FTA content may not be marked Copy Never.

8.9 CPCM Certificates

A CPCM C&R regime defines the conditions under which the following fields in a Certificate are to be asserted or not:

- AD_aware
- ADM_capable
- ADM_LM_capable
- ADM_DC_capable
- ADSE_countable
- LSA_capable
- absolute_time_capable
- geographic_aware

It defines the policy to allocate an expiration date to a certificate. It may define additional conditions to the ones defined in TS 102 825-4 [i.8] under which the expiration time of a certificate is required to be present.

A CPCM C&R regime defines at which frequency or under which circumstances it updates the certificate generation index for the issuance of both new CPCM certificates and CPCM Revocation Lists.

8.10 Mapping rules

When an external CPS becomes a trusted input or a trusted or controlled output for CPCM, a mapping is to be defined between rights supported by this CPS and CPCM USI (and possibly CPCM Extensions). Upon definition of this mapping, undefined states should be avoided as much as possible otherwise there is a risk of ambiguity in mapping, which may lead to variations in interpretation by differing implementations. This is undesirable for reasons of content protection (threat of accidental loosening of restrictions) and usability (inconsistent user experience).

When defining the mapping between CPCM USI and some external CPS authorized usage, compliance bodies should avoid restricting possibility of content usage for the user, particularly when only one single instance of the content may exist (i.e. content is marked Copy Once/Copy No More within CPCM) as the loss of rights could be irreversible. If the content is marked CCNA, usage restriction when exporting to a DRM system is more acceptable as the user can retain a copy with the original set of USI within CPCM.

One challenge in defining the mapping rules is that different CPS generally rely on fundamentally different concepts. Even though a CPS may support a domain concept, one cannot simply assume that the CPS's domain definition is equivalent to the DVB CPCM Authorized Domain concept.

EXAMPLE: OMA DRM [i.9] leaves the domain policy (which devices are allowed to join a certain domain) up to the rights issuer, and therefore it may not even be known to the compliance body whether the devices that are members of a particular OMA DRM domain are owned, rented or otherwise controlled by a single household. If CPCM content that is restricted to an Authorized Domain is to be exported to an OMA DRM domain, care needs to be taken to ensure that the domain policy in that particular domain is an acceptably close match to the DVB CPCM Authorized Domain concept.

If CPCM content that is restricted to an Authorized Domain is allowed to be copied to another CPS that has a similar domain concept, care needs to be taken to make sure this feature cannot be misused to copy the content to a number of different domains - either in the same CPS, or even in different CPSs - which are not owned, rented or otherwise controlled by the same user, family or household. This could require a common management system for Domain across the different involved CPSs and CPCM.

8.11 Temporary storage of Copy Never content

Typically, buffering is for one of two purposes; the first is to allow processing of the content such as recompression or frame rate conversion and in this case the content is usually buffered in the system RAM. The second purpose is buffering for delayed viewing for example in the event that playback is paused in which case the C&R Regime defines the period of time that content marked Copy Never Zero Retention Not Asserted may stay in temporary storage.

The C&R Regime specifies in both cases the robustness associated with the buffers, for example clearing on the buffer when the need to buffer has ended.

8.12 Non repudiation

The C&R regime is recommended to deal with non-repudiation for content marked View Period activated. The purpose is to prevent the user from denying having played the content and hence claiming for a new View Period.

8.13 System parameters

For the CPCM System to work properly, implementers have to define timeouts for CPCM protocols implementation in order to provide the user with a good experience. A C&R Regime may impose upper or lower limits for these timeout values.

It may happen that a CPCM Device has the choice of the network or physical interface it can use in order to exchange content or CPCM messages because he has in common several of them with the destination CPCM Device. In such case, the C&R Regime may impose one or a limited set of interfaces the CPCM Device should use, e.g. because proximity tests perform better on certain interfaces.

8.14 Proximity

TS 102 825-4 [i.8] mandates two tools to assess proximity. The C&R Regime specifies the parameters for these two tools.

The C&R Regime specifies which proximity tools, if any, are required beyond the mandatory tools defined in TS 102 825-4 [i.8]. The selection of proximity tools is a matter for the C&R Regime both because of the robustness and efficacy of the tool, and because of the parameters that will be used to determine whether two devices are local. The C&R Regime may also adopt optional proximity tools. Some optional tools may be found in TS 102 825-4 [i.8] and TS 102 825-9 [i.10] but others can be adopted by the C&R Regime.

Where the C&R Regime permits more than one proximity tool to be used the C&R Regime specifies a proximity tools precedence order to be followed by CPCM Devices that are capable of implementing multiple proximity tools. This would give precedence to more reliable tools, with a logical "false" of a test overriding a logical "true" of another less reliable test. Any such variations from the strict logical OR of the methods described in the present document will be specified by the C&R Regime.

The C&R Regime may also specify parameters required by any other proximity tool that it mandates or authorises as optional. Examples of these Proximity Tools and their parameters can be found in TS 102 825-4 [i.8] and TS 102 825-9 [i.10].

8.14.1 RTT proximity tool

Required parameters for these tools are:

- Network_Type: The C&R Regime defines the different network technologies on which this tool may be used.
- The RTT_maximum_time for each different network_type. The CPCM instance uses the RTT_maximum_time associated with the network_type of the particular physical network interface, e.g. PHY and LINK types, over which the RTT test is being conducted.
- The RTT_persistence. The C&R Regime specifies the frequency at which this test should be performed.

8.14.2 SRTT proximity tool

Required parameters for these tools are:

- Network_Type_Tester: The C&R Regime defines the different network technologies on which these tools may be used.
- SRTT_Maximum_Time which will be independently set for each Network_Type_Tester and which will be protected against unauthorised modification.
- SRTT_Persistence: The C&R Regime specifies the frequency at which this test needs to be performed.
- SRTT_Adjustment_Value_Testee if applicable for each network technology.

8.15 Authorised Domain management

Since trust establishment is required to join an AD, consequently an AD can only be set up between devices that can establish mutual trust as described in clause 8.1. This means that an AD may only encompass CPCM devices compliant with a common C&R Regime or C&R Regimes that trust each other.

The C&R Regime has to define the ADSE method that will be used by compliant devices and, whether it requires additional tools to the default method specified in TS 102 825-7 [i.11]. Some additional tools are proposed in TS 102 825-7 [i.11].

If the C&R Regime requires ADM, it should define one or more ADMAAA that can be involved in AD management protocols and, for each ADMAAA, define the relevant protocols that would be required for the ADMAAA to assess whether the requested authorization may be granted or not. It defines also for each ADM AAA how it can be contacted.

The C&R Regime specifies all parameters needed for the ADSE method, namely: total_ceiling, remote_ceiling, local_ceiling, DC_split_ceiling, DC_remote_ceiling, history_ceiling. For the latter values, different ceilings may be chosen for rented and owned CPCM devices.

The ceilings can be changed at any time by an ADMAAA or by any test approved by the C&R Regime.

The C&R Regime specifies the permitted hardware, software, middleware and other technologies employed for AD management. It will enforce the requirement that a CPCM instance may only be a member of one AD at a time.

Some CPCM instances may be AD-aware without being ADM capable. For example, this might be the case for smart cards implementing a proprietary CA or DRM that is plugged into a set-top-box with proprietary software and CPCM instance. The set-top-box CPCM instance may let the smart card CPCM instance join using proprietary protocols in accordance with rules set forth in a particular C&R Regime.

The C&R Regime may place constraints upon the number of potential outputs that may be included in a single CICF. The instance certificate includes the ADSE_countable field that contains a "0" or "1". The instance certificate contains a "1" in this field if the instance includes a Consumption Point or an Export Point. The C&R Regime may require that a future CPCM Device be counted as more than "1". In such a case the Compliance Body will require that the CPCM Device includes multiple CPCM instances with this field set to '1'.

The CPCM specification manages AD membership at the level of the CPCM instance. If a CPCM Device incorporates multiple CPCM instances, the C&R Regime rules may require that each instance, if a member of an AD, is a member of the same AD. If the C&R Regime requires that every instance is a member of the same AD it specifies the mechanism by which this will be determined in the context, where each CPCM instance operates independently within a single compliant device, as in the example of two software CPCM instances running as applications from different vendors on a single PC, where the hardware and operating system are not CPCM aware. How this may be accomplished is outside of the scope of the present document.

A product may incorporate more than one CPCM Device. Membership of a single AD by such a product will be in accordance with the C&R Regime rules for the corresponding product category.

The C&R Regime also has to define which rules and ceilings will be applied for CPCM Devices implementing several C&R Regimes. In practice this can only be done by agreement between the Compliance Bodies of the respective C&R Regimes.

The C&R regime may add additional constraints on the rebalancing of ADSE values performed during the Domain Controller Rebalance protocol.

8.16 Extensions

When a C&R Regime decides to support a CPCM extension or a private extension, it may have to define particular rules for that extension. This clause defines such rules for CPCM Extensions, as defined in TS 102 825-14 [i.12].

If a C&R Regime does not describe rules governing a given Extension, use of the Extension is presumed to be prohibited without explicit permission from the C&R Regime.

8.16.1 Play Count Extension

When a C&R regime decides to support the CPCM Play Count Extension, it has to decide what will be considered as one play. Thus, it will define under which conditions the remaining count is decremented in CPCM Auxiliary Data.

EXAMPLE: It may mandate to decrement this count as soon as the Play starts but to authorize to re-increment or to revert back to the original Content Licence if certain conditions are met (e.g. only a small part of the Content has been played).

If a Move of a Play Count restricted Content occurs with a Storage Entity that already holds a Content Licence for the same Content, the C&R regime may allow an implementation to generate a new Content Licence with aggregated counts.

The C&R regime is recommended to deal with non-repudiation. The purpose is to prevent the user from denying having played the content and hence claiming for additional play counts.

9 System renewability

The compliance body licence or agreement stipulates the conditions under which system renewability messages can be initiated. These conditions describe the technical requirements for determining whether a device security has been compromised (for example the device's keys are being distributed outside of their proper usage) and any procedure that will be followed by the device manufacturer to address the situation. The compliance body will also have in place agreements with channel operators, those who own the means of delivering content to the end user, to carry system renewability messages (SRM).

A compliance body may appoint one or more certificate authorities for the purpose of issuing certificates but to comply with the normative parts of this specification appoints only one for the purpose of issuing revocation lists. The CA that generates revocation certificates does not necessarily have to be one of the CA that issue certificates.

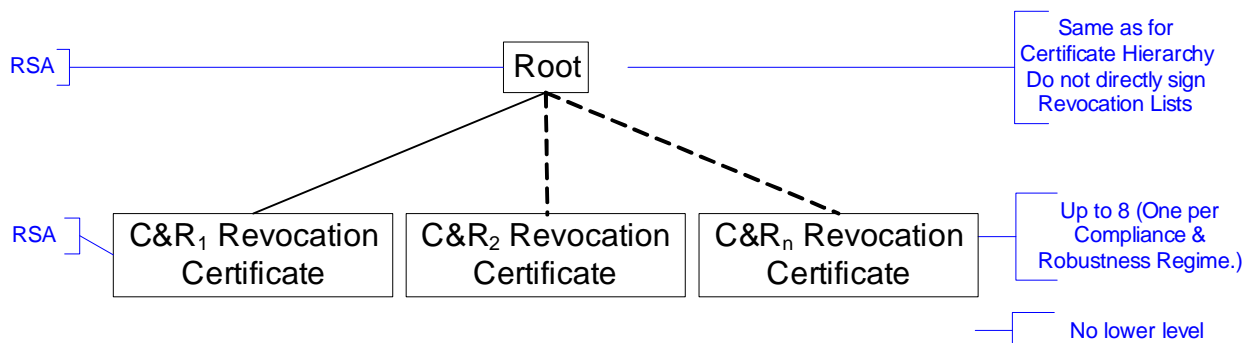


Figure 18: CPCM revocation tree

9.1 Revocation process and security

Upon receiving the list of revocation certificates the device checks the signature of the list as described in TS 102 825-5 [i.13]. The CPCM instance hosting an Acquisition Point compiles the complete CPCM revocation list received within its content delivery channel(s) and maintains the latest version in accordance with detailed requirements laid out by the C&R Regime. By broadcasting `get_RL_message` that requests one or more revocation lists issued by different compliance bodies with a minimum index, each CPCM instance having a revocation list for the relevant C&R Regime with an index not lower than the requested one will provide the Revocation List using the `notify_RL_message`. If a CPCM Instance has more than one of the requested lists, it will use several instances of the `notify_RL_message`.

The compliance body should require that each CPCM instance permanently records in non-volatile storage the latest Revocation List which is the Revocation List with highest index for each of the C&R Regime with which it complies. The compliance body license and compliance rules should specify any storage requirements for the system renewability messages contained in the Revocation List.

The CPCM content licence structure contains the field `c_and_r_regime_mask`, which is an 8-bit mask that also implies for which of the eight possible C&R Regimes a revocation check is to be performed for the associated CPCM Content item.

CPCM Device-based content revocation checks can be applied in the following cases:

- by the CPCM instance that hosts the Acquisition Point for input Content against which that CPCM instance should be checked; or
- by a source CPCM instance prior to delivering CPCM Content to a sink CPCM instance.

NOTE: The content license includes a field `RL_index` which specifies the revocation list which will be applied. If the field is 0 then no revocation list should be applied.

In order to be able to manage, use, or otherwise handle CPCM Content, a CPCM instance needs to be authorized and not revoked for at least one of the C&R Regimes required in the content licence that it implements.

9.2 Renewability process and security

The present document does not specify or require any renewability mechanism. However, a CPCM instance implementer may decide to implement such a mechanism to renew:

- the entire CPCM Instance implementation; or
- the implementation of the CPCM instance and associated private key; or
- any element of a CPCM function; or
- the lists of trusted and/or controlled exports; or
- the list of proximity tools.

NOTE: The above is a non-exhaustive list.

A C&R Regime may also decide to require CPCM instance implementers to implement a renewability mechanism.

The C&R Regime decides upon the minimal security that the renewability mechanism will achieve and upon its associated robustness.

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Annex A: Change History

Version	Date	Milestone
R2	22/05/07	ETSI template applied to R1
R6	19/11/07	Added material from SB-CAR and CPT for plenary discussion
R7	17/12/07	Inclusion of text of references to C&R Regime from Compliance capture doc. TM-CPT1443R2. (TM-CPT1443 updated to R3 to show the Sections in TM-CPT1355R7 in which the text has been allocated)
R8	31/12/07	Additional material, editorial changes and cleaned up diagrams (for clarity old versions of diagrams are not shown as a revision)
R9	03/01/08	GGB and CH editorial
R10	03/01/08	Changes in R9 accepted
R11	15/01/08	Working doc in TM-CPT meeting 59
R12	18/01/08	Updated fro output of TM-CPT59
TM-CPT1423R2	18/01/08	Reverted to CPCM Part 13 numbered doc sequence Title corrected to Part 13 from Part 11
TM-CPT1423R3	11/02/08	Further amendments – issued for review at TM-CPT meeting 60
TM-cpt1423_mark up	13/02/08	TM-CPT #60 Plenary review up to, and including clause 8.3
TM-CPT1423R4	03/03/08	Re-ordered document, changes in R3 mark-up accepted, further editorial changes made, completed remaining sections
TM-CPT1423R5	06/03/08	AD action items and review
TM-CPT1423R6	11/03/08	TM-CPT #61 Plenary review of entire document. Publish as R6 and R6 Mark Up.
TM-CPT1423R7	March 08	Editorial changes
TM-CPT1423R8	10/04/08	TM-CPT#62 Plenary review of changes and additions in R7
TM-CPT1423R9	18/05/08	Editorial changes, added storage section and re-wrote sections relating to Hook IP, etc.
TM-CPT1423R10	17/06/08	Revision of definitions and consequent changes to the document.
TM-CPT1423R11	03/07/08	Further changes to definitions and consequent use of those terms in the document
TM-CPT1421R13	03/07/08	Filed as final clean version out of TM-CPT meeting 64 – for editorial review
TM-CPT1421R14	13/09/08	ETSI-fication TM-CPT meeting 67

History

Document history		
V1.1.1	February 2011	Publication