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Embedded Common Interface (ECI) for exchangeable CA/DRM solutions; Part 1: Architecture, Definitions and Overview

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Foreword

This Group Specification (GS) has been produced by ETSI Industry Specification Group (ISG) Embedded Common Interface (ECI) for exchangeable CA/DRM solutions.

The present document is part 1 of a multi-part deliverable covering the Architecture, Definitions and Overview for the Embedded Common Interface for exchangeable CA/DRM solutions specification, as identified below:

Part 1: "Architecture, Definitions and Overview";

Part 2: "Use cases and requirements";

Part 3: "CA/DRM Container, Loader, Interfaces, Revocation";

Part 4: "The Virtual Machine";

Part 5: "The Advanced Security System";

Part 6: "Trust Environment".

Modal verbs terminology

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Introduction

Service and content protection realized by Conditional Access (CA) and Digital Rights Management (DRM) are essential in the rapidly developing area of digital broadcast and broadband services. This includes the distribution of HD and UHD content to various types of customer premises equipment (CPE) in order to protect business models of content owners and service providers, including broadcasters and PayTV operators. While CA systems primarily focus on the protection of content distributed via unidirectional networks as usually used in broadcast environment, DRM systems originate from bidirectional network environments and permit access to content on certified devices for authenticated users, with typically rich content rights expressions. In practice, a clear distinction between CA and DRM functionalities is not feasible in all cases and therefore within the present document the term CA/DRM systems is used.

Currently implemented CA/DRM solutions, whether embedded or as detachable hardware, often result in usage restrictions for service/platform providers on one side and consumers on the other. The consequences for consumers are dependencies with regard to the applicable network, service and content providers and the applied CPE suited for classical digital broadcasting, IPTV or OTT (over-the-top) services. While CPEs with embedded platform-proprietary CA or DRM functionality bind a customer to a specific platform operator, detachable hardware modules allow using retail CPE as e.g. Set-Top-Boxes (STB) and integrated TV sets (iDTV). Due to their form factor and cost, detachable hardware modules do not fulfil future demands, especially those with regard to consumption of protected content on tablets and mobile devices and for cost-critical deployments.

Existing technologies thus limit the freedom of many players in digital multimedia content markets. Due to technological progress, innovative, software-based CA/DRM solutions become feasible. Maximizing interoperability while maintaining a high level of security, these solutions promise to meet upcoming demands in the market, allow for new businesses, and broaden consumer choice with respect to content consumption via broadcast and broadband connections.

It is in consumers' interest that bought and owned CPEs are available for further use after a move or a change of the network provider and that those devices can be utilized for services of different commercial video portals. This can be achieved by the implementation of interoperable CA and DRM mechanisms inside CPEs based on appropriate security architecture. Further fragmentation of the market for CPEs can only be prevented and competition encouraged by ensuring solutions for consumer-friendly and flexible exchangeability of CA and DRM systems, associated with a state-of-the-art security environment.

It is in the platform operator's interest that security technology can be deployed flexibly and managed easily across various networks and on all kinds of devices. The advantage of updating existing devices with the latest security systems in a seamless way provides unparalleled business opportunity.

1 Scope

The present document specifies the architecture of an **ECI Ecosystem**. A major advantage and innovation of the **ECI Ecosystem**, compared with currently deployed systems, is a complete software-based architecture for the loading and exchange of CA/DRM systems, avoiding any detachable hardware modules. Software containers provide a secure ("Sandbox") environment for either CA or DRM kernels, hereafter named as **ECI Clients**, together with their individual **Virtual Machine** instances. Necessary and relevant Application Programming Interfaces (API) between **ECI Clients** and **ECI Host** ensure that multiple **ECI Clients** can be operated in a secure operation environment and completely isolated from the rest of the CPE firmware and are specified in full detail. The installation, verification, and exchange of an **ECI Host** as well as multiple **ECI Clients** is the task of the corresponding **ECI** loaders. **ECI Host** and **ECI Clients** are downloaded via the DVB data carousel for broadcast services and/or via IP-based mechanisms from a server in case of broadband access. This process is embedded in a secure and trusted environment, providing a trust hierarchy for installation and exchange of **ECI Host** and **ECI Clients** and thus enabling an efficient protection against integrity- and substitution attacks. For this reason, the **ECI Ecosystem** integrates an advanced security mechanism, which relies on an efficient and advanced processing of control words, specified as "Key Ladder Block" and integrated in a System-on-chip (SoC) hardware in order to provide the utmost security necessary for **ECI** compliance.

ECI-specific advanced security functions play also a key role in a re-encryption process in case of stored protected content and/or associated with export of protected content to an **ECI**-compliant or non-compliant external device. An advanced Micro DRM system provides the necessary functionality and forms an integral part of such a concept. Advanced security functionality is relevant also in case of revocation of a CPE or a specific **ECI Client**. Related APIs are specified within the present document, while advanced security is covered in detail by ETSI GS ECI 001-5-1 [4] and ETSI GS ECI 001-5-2 [5].

A number of APIs characterize the **ECI Ecosystem**, guaranteeing communication with relevant entities associated e.g. with **ECI** Loaders, import and export of protected content, advanced security, decryption and encryption, local storage facilities and watermarking. Additional APIs are available for **ECI Client** Man-Machine-Interface (MMI) or for an optional **Smart Card** reader. Exchange of **ECI Clients** is initiated by the user or may be requested by a platform operator in case of necessary updates. A minimum of two **ECI Clients** are supported, with two additional **ECI Clients** as far as local storage on a Personal Video Recorder (PVR) is available or for export reasons. Guidance and recommendations on how to implement the **ECI** system are given in ETSI GR ECI 004 [i.1].

The present document covers the **ECI** architecture in the following clauses:

- Clause 4 covers the technical concept, core functionalities, and security aspects of the **ECI** system.
- Clause 5 addresses the basic requirements and structure for an **ECI Trust Environment**.
- Annex A gives an exemplary overview of the operational workflows of an **ECI Trust Environment**.

The **ECI** specification only applies to the reception and further processing of content which is controlled by a Conditional Access and/or Digital Rights Management system and has been encrypted by the service provider. Content that is not controlled by a Conditional Access and/or DRM system is not covered by the present document.

The **ECI** Group Specification is intended to be used in combination with a contractual framework (license agreement), compliance and robustness rules, and appropriate certification process (see note), under control of a **Trust Authority**, ETSI GS ECI 001-6 [6].

NOTE: Contractual framework (license agreement), compliance and robustness rules, and appropriate certification process are not subject to the standardization work in ISG **ECI**.

2 References

2.1 Normative 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 https://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.

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

[1] ETSI GS ECI 001-2 (V1.2.1): "Embedded Common Interface (ECI) for exchangeable CA/DRM solutions; Part 2: Use cases and requirements".

[2] ETSI GS ECI 001-3: "Embedded Common Interface (ECI) for exchangeable CA/DRM solutions; Part 3: CA/DRM Container, Loader, Interfaces, Revocation".

[3] ETSI GS ECI 001-4: "Embedded Common Interface (ECI) for exchangeable CA/DRM solutions; Part 4: The Virtual Machine".

[4] ETSI GS ECI 001-5-1: "Embedded Common Interface (ECI) for exchangeable CA/DRM solutions Part 5: The Advanced Security System Sub-part 1: ECI specific functionalities".

[5] ETSI GS ECI 001-5-2: "Embedded Common Interface (ECI) for exchangeable CA/DRM solutions; Part 5: The Advanced Security System; Sub-part 2: Key Ladder Block". .

[6] ETSI GS ECI 001-6: "Embedded Common Interface (ECI) for exchangeable CA/DRM solutions; Part 6: Trust Environment".

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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 GR ECI 004: "Embedded Common Interface (ECI) for exchangeable CA/DRM solutions; Guidelines for the implementation of ECI".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

advanced security: function of an **ECI** compliant CPE which provides enhanced security functions (hardware and software) for an **ECI Client**

NOTE: The details are specified in ETSI GS ECI 001-5-1 [4] and ETSI GS ECI 001-5-2 [5].

Embedded CI (ECI): architecture and the system specified in the ETSI ISG "Embedded CI", which allows the development and implementation of software-based swappable **ECI Clients** in customer premises equipment (CPE) and thus provides interoperability of CPE devices with respect to **ECI**

Embedded CI Client (ECI Client): implementation of a CA/DRM client which is compliant with the Embedded CI specifications

NOTE: It is the software module in a CPE which provides all means to receive, in a protected manner, and to control execution of a consumer's entitlements and rights concerning the content that is distributed by a content distributor or operator. It also receives the conditions under which a right or an entitlement can be used by the consumer, and the keys to decrypt the various messages and content.

ECI client loader: software module part of the **ECI Host** which allows to download, verify and install new **ECI Client** software in an **ECI Container** of the **ECI Host**

Embedded CI Container (ECI Container): single **VM instance** with complementary support libraries and **ECI** API that permits a single instance of an **ECI Client** to run on a CPE

ECI Ecosystem: commercial operation consisting of a **TA** and several platforms and **ECI** compliant CPEs in the field

ECI Host: hardware and software system of a CPE, which covers **ECI** related functionalities and has interfaces to an **ECI Client**

NOTE: The **ECI Host** is one part of the CPE firmware. The **ECI Host** is responsible to ensure the isolation of each **ECI Container** and provides authenticated loading of **ECI Clients**.

ECI Host Loader: software module which allows to download, verify and install **ECI Host** software into a CPE

NOTE: In a multi-stage loading configuration this term is used to refer to all security critical loading functions involved in loading the **ECI Host**.

entity, entities: organization (e.g. manufacturer, operator) or real-world item (e.g. **ECI Host**, **ECI Client**) identified by a unique ID in an **ECI Ecosystem**

home domain: User's home network containing at least one **ECI** compliant CPE

Trust Authority (TA): organization governing all rules and regulations that apply to implementations of **ECI**

NOTE: The **Trust Authority** has to be a legal entity to be able to achieve legal claims. The **Trust Authority** needs to be impartial to all players in the downloadable CA/DRM ecosystem.

trust environment: collection of rules and related process that constitutes the basis for an **ECI Ecosystem**

Trusted Third Party (TTP): technical service provider which issues certificates and keys to compliant manufacturers of the relevant components of an **ECI-System**

NOTE: It is under control of the **Trust Authority (TA).**

user: person who operates an **ECI** compliant device

Virtual Machine Instance (VM instance): instantiation of VM established by an **ECI Host** that appears to an **ECI Client** as an execution environment to run in

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

API	Application Programming Interface
CA	Conditional Access
CENC	Common Encryption
CI	Common Interface
CPE	Customer Premises Equipment
DRM	Digital Rights Management
DVB	Digital Video Broadcasting
ECI	Embedded Common Interface

HD	High Definition
HTTP	HyperText Transfer Protocol
iDTV	integrated Digital TV receiver
IP	Internet Protocol
IPTV	TV services delivered via IP protocol
ISO	International Standards Organization
LA	License Agreement
MMI	Man-Machine-Interface
MPEG	Motion Picture Experts Group
OS	Operating System
OSD	On Screen Display
OTT	Over The Top
PIN	Personal Identification Number
PVR	Personal Video Recorder
ROM	Read Only Memory
SI	Service Information
STB	Set-Top-Box
TA	Trust Authority
TTP	Trusted Third Party
TV	TeleVision
UHD	Ultra High Definition
UI	User Interface
VM	Virtual Machine

4 The technical concept of the **ECI** System

4.1 Basic considerations

The present document, in combination with parts 2 to 5-1 and 5-2 of the multi-part deliverable ([1], [2], [3], [4], [5] and [6]), specifies an architecture allowing downloading, installation, upgrading, removal and replacement of **ECI Clients** at any time, independently from other **ECI Clients** running on the same **ECI Host**, the **ECI Host** CPE's system software or applications running on that **ECI Host**. An **ECI Host** shall be capable to accommodate and to provide the runtime environment for as many **ECI Clients** as its resources can handle, but at least two. The **ECI Clients** shall be able to run in parallel, enabling simultaneous decryption or re-encryption of different content streams from different operators. Guidance and recommendations on how to implement the **ECI** system are given in ETSI GR ECI 004 [i.1].

The technical concept described in the present document and specified in [2] to [5], is applicable to both DVB Multicrypt compliant CA systems and Common Encryption (CENC) compatible DRM systems.

The CPE hosts a special loader only for **ECI Clients** with the necessary security functionality to protect the integrity and authenticity of the **ECI Clients**. This loader can be called and operated at any time to download and verify another **ECI Client** at any time. The loader with its associated security facilities is specified in ETSI GS ECI 001-4 [3].

Concerning this technical concept, each **ECI Client** is installed in a separate software container, with its own **Virtual Machine Instance** (**VM Instance**), which is specified in ETSI GS ECI 001-4 [3]. The **ECI Container** is specified for CA/DRM functionality only, which is reflected in ETSI GS ECI 001-3 [2]. The interface with the CPE, detailed in ETSI GS ECI 001-3 [2], enables the request and data exchange that is needed for the various CA/DRM functions. These requests and data exchanges may be performed between the **ECI Client** and the **ECI Host**, between two **ECI Clients** in the same **ECI Host** or two **ECI Clients** in different **ECI Hosts**.

TV-centric devices are defined as devices which include MPEG-2 transport stream processing inside the chip-set. **ECI** requires that those chip-sets implement **ECI**-compliant **Advanced Security** functionalities. ETSI GS ECI 001-5-1 [4] specifies provisions to leverage **Advanced Security** mechanisms in the chip-set, such as to protect the key associated with the content during its travel into the CPE processor chip's content decryption facility. This **Advanced Security** concept allows all **ECI Clients** using the facility, if needed, to operate simultaneously and independently from each other.

Devices for other environments, especially IPTV and tablets, smartphones, etc. typically implement more functionality in software and offer bidirectional IP-communication. This enables specific new types of security enhancement mechanisms. As chip-sets used in those devices include hardware for various processing security functions, **ECI** requires dedicated hardware-assisted security and robustness functionalities to be implemented in order to achieve **ECI**-compliance. Therefore, ETSI GS ECI 001-3 [2] includes methods for the **ECI Client** to obtain the relevant parameters of the **ECI Host**'s technical capabilities and functionalities, as far as relevant, including possible support of the **Advanced Security** as specified in ETSI GS ECI 001-5-1 [4] and ETSI GS ECI 001-5-2 [5].

The **Advanced Security** functionalities are available simultaneously to any **ECI Client** active in a CPE. **ECI Clients** can also be deployed in platforms with DVB compliant CA systems or with CENC compliant DRM systems running in simulcrypt or multicrypt mode, as long as the server sides of those systems are compliant with the respective DVB/CENC backend standards.

4.2 Architectural overview

The **ECI** allows CA/DRM providers to implement solutions for Conditional Access (CA) as well as for Digital Rights Management (DRM) within the domain of an individual customer. Figure 1 shows a reference configuration which is fully supported by a complete **ECI** implementation.

In order to support multi-screen environments within the individual consumer's domain, **ECI Clients** within that domain may communicate with each other, and may make use of a bidirectional network with the provider, depending on the availability of appropriate networks and supporting functionalities in the CA/DRM systems and their **ECI Clients**. ETSI GS ECI 001-3 [2] defines the necessary APIs required for those functionalities.

An **ECI Client** may be implemented in such a way that it is able to operate as a gateway also to non-**ECI**-conformant clients. The necessary APIs for it are specified in ETSI GS ECI 001-3 [2]. The specific protocols and implementations of proprietary clients are out of scope of the **ECI** specifications.

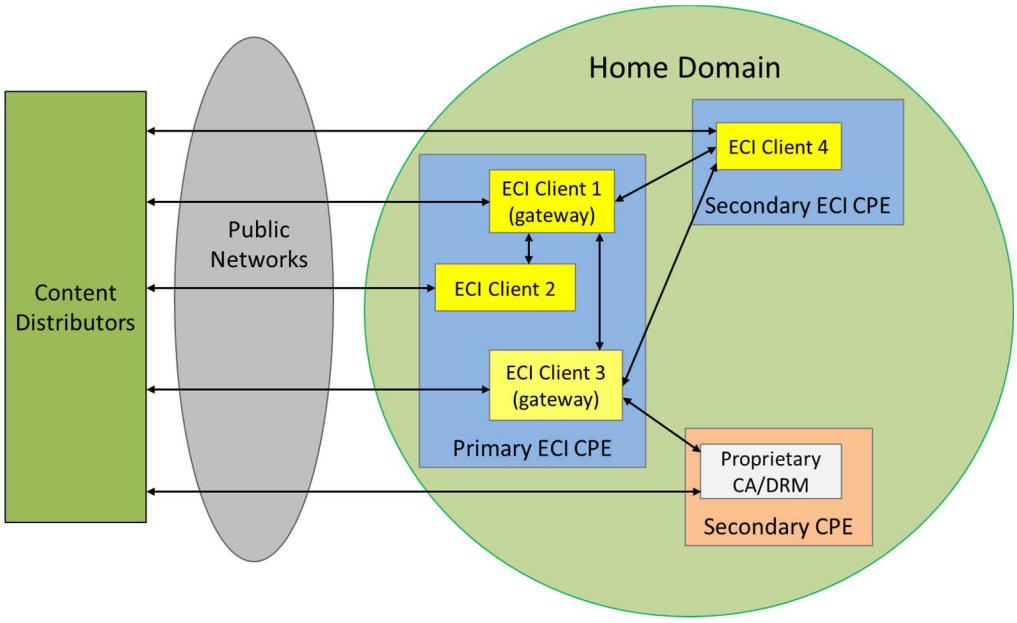


Figure 1: Multiple ECI Clients within a single Home Domain

The **ECI** specifications define, amongst others, the interface between an **ECI Client** and the **ECI Host.** Figure 2 shows the block diagram of a CPE with **ECI Clients**, and the other functions in the **ECI Host** that the **ECI Clients** may make use of. Some of these functions are optional. During the installation of an **ECI Client** and during launch of an **ECI Client**, the **ECI Host** specifies which relevant functions it has available to the **ECI Client**.

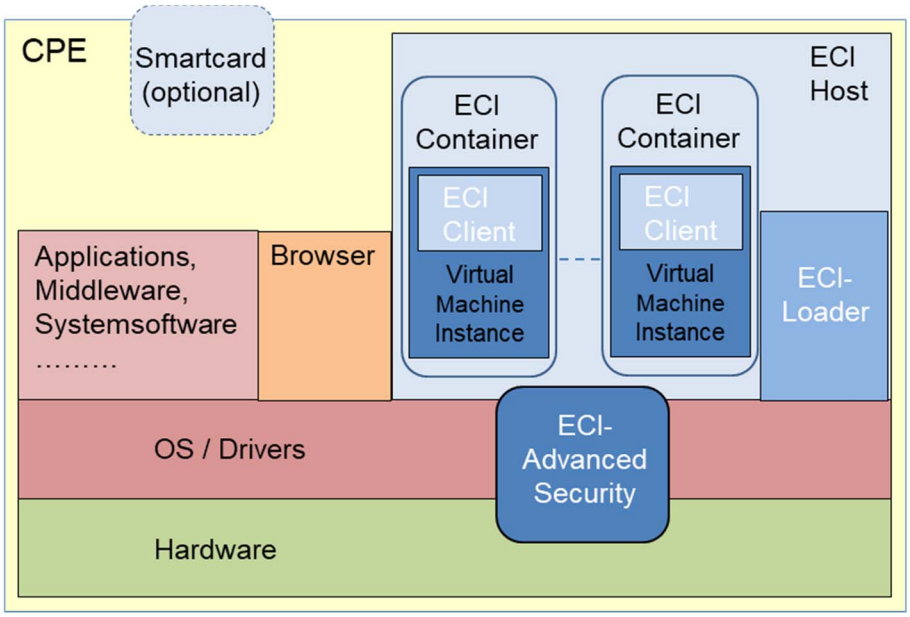


Figure 2: Block diagram of a CPE with embedded ECI Clients, each with their own ECI Container and Virtual Machine Instance

First of all, the concept is based on a hierarchical loader concept consisting of a chip-based loader, the system software loader and the **ECI Client Loader**.

The **ECI Host Loader** loads the **ECI Host** software. This includes besides other elements the virtual machine, access to advanced security components, and the **ECI Client Loader**. An **ECI Host** can load multiple **ECI Clients** into separate virtual machine instances, which run independently and isolated against each other.

When loading an **ECI Client** into the system a virtual machine instance is created in which the **ECI Client** is started. This **VM Instance** acts as a sandbox between the **ECI Client** and the **ECI Host**. The interface between the **ECI Host** and the **ECI Client** is the key interface which the GS specifies. The interface also specifies the information flow and protocols between multiple instances of such an **ECI Client** and to other functionality inside the CPE, like advanced security, display, etc.

The **ECI Host** itself depends on the manufacturer implementation. **ECI** specifies the APIs for the communication of the **ECI Host** with the **ECI Clients**. The **ECI Host** interfaces to the OS and the driver layer and provides all functionalities defined by the **ECI Client** interface specification. The **ECI-Host** needs to be certified by the **Trust Authority** in order to ensure compliance with the **ECI** specifications.

4.3 Mandatory functionality of **ECI** compliant devices

ECI addresses a range of usage scenarios (see figure 1). Hence, **ECI** has to deal with a broad range of devices ranging from iDTVs, STBs, PVRs, IPTV, tablets, smartphones, etc. Those devices vary in their capabilities while **ECI** provides a harmonized security framework. **ECI** distinguishes TV-centric devices from devices for other environments, including but not limited to IPTV and mobile devices, such as tablets.

TV-centric devices are defined as devices which include MPEG-2 transport stream processing inside the chip-set. **ECI** requires that those chip-sets implement **ECI**-compliant advanced security functionalities. TV-centric **ECI** compliant CPEs shall be compliant with the functions as given in the specifications [2], [3], [4] and [5].

Devices for other environments especially IPTV, computers, and tablets typically implement more functionality in software and connect to a bidirectional IP-communication. This enables different types of security mechanisms. As chip-sets used in those devices include hardware for various security processing functions, **ECI** requires dedicated hardware-assisted security and robustness functionalities to be implemented in the chip-sets.

4.4 Necessary Interfaces between **ECI**-Host and **ECI**-Client

The **ECI Container** is a technical concept combining the VM and the **ECI Client** with the objective to isolate and to shield the VM and the **ECI Client** from the rest of the CPE. The virtual machine is a functionality of the **ECI Host**. By loading an **ECI Client** the **ECI Host** creates a **Virtual Machine Instance**. The **VM Instance** provides the necessary interfaces to the **ECI Client** and the related APIs allow the **ECI Client** to communicate with the **ECI Host,** The following list highlights important software interfaces:

- Interface for capability information from **ECI Host** to **ECI Client** and vice versa
- Interface to the processing of input and outputs signals of the CPE
- Interface to the **Advanced Security** hardware/drivers block
- Interface to **Loader** functionalities
- Interface to support **User** interaction
- Interface to encryption and decryption functionality
- Interface to the optional Smartcard reader
- Interface to specific security functionalities like fingerprinting and watermarking
- Interface to local storage

All interfaces of the **ECI Client** are provided by means of the virtual machine.

There are in addition communication protocols on top of the interfaces allowing a secure communication. In particular a protocol to establish communication between **ECI Clients**, regardless if internal or external, is being specified.

The CPE can be connected to any type of network and several networks concurrently, both unidirectional or bidirectional. It does not need to be "always on"-connected to any network from the perspective of the **ECI**-architecture.

4.5 A minimum User Interface and Display functionality

For communications with the **User**, a minimum UI and OSD facility shall be available to the **ECI containers**. This is specified in ETSI GS ECI 001-3 [2]. It is used to display messages for the **User** that have been generated by or sent using the CA/DRM system. Also, it is used to allow the **User** entering inputs, such as a PIN. Details are specified in ETSI GS ECI 001-3 [2] as well.

The **User** interacts locally with the CA/DRM system through the **ECI Client**.

4.6 The Virtual Machine

The **ECI Client** runs upon a standardized virtual machine. This component is specified in ETSI GS ECI 001-4 [3]. Each installed **ECI Client** shall have its own instance of the VM. The **VM Instance** provides a secured environment for executing Conditional Access or Digital Rights Management client applications. APIs are provided by the VM to access resources of the **ECI Host** environment in a standardized way.

4.7 The "**Advanced Security**" facility

ECI defines minimum necessary security functionalities required to build a secure content protection system. **ECI** requires enhancements based on hardware-elements. In TV-centric devices this is delivered by TV-specific dedicated advanced security functions. It specifies what is usually referred to as a "Key Ladder Block" in SoCs. An essential task of the **Advanced Security** facility is to protect the content protection keys during its transmission from the **ECI Client** to the content decryption facility in a CPE or the transfer of protected content from one **ECI Client** to another **ECI-Client** (see figure 1).

The **Advanced Security** system as specified in ETSI GS ECI 001-5-1 [4] and ETSI GS ECI 001-5-2 [5] supports different simultaneous Control Word streams and different **ECI Clients** that are simultaneously requesting its services. Furthermore the **Advanced Security** facility plays a key role to verify the download of the software for the **ECI Host** and the **ECI Clients**.

Devices for other environments especially IPTV, computers, and tablets typically implement more functionality in software and connect to a bidirectional IP-communication. **ECI** specifies the same advanced security concepts and mechanisms for such devices but it is up to the **Trust Authority** of an **ECI Ecosystem** to decide on the mandating of certain advanced security functionalities for such type of devices.

4.8 Re-scrambling

Customers might decide to consume protected content which has been received by an **ECI** compliant CPE not immediately, but at a later time. The following functionalities are available with **ECI** compliant devices to facilitate this:

- Local storage:
  - under control of the CPE;
  - under control of a CA- or DRM client.
- Gateway:
  - delivery of a protected content element to an external device under control of a DRM microserver;
  - delivery of a protected content element to another **ECI Client** either inside the same CPE or running on another **ECI** compliant CPE.

To support these functionalities the **ECI** compliant device is able to re-scramble content. The **ECI** system does not specify the transport mechanisms nor the available DRM functionalities for storage or delivery of protected content to other devices. In ETSI GS ECI 001-3 [2] the necessary interfaces between the **ECI Host** and the **ECI Client** are defined.

4.9 The **ECI** loader functionalities

An **ECI** compliant CPE shall provide loader functionalities, allowing loading and installation, as well as integrity and anti-tampering protection of the relevant software modules of the **ECI** system.

Initially, the chip loader embedded in the CPE chipset verifies and loads the CPE firmware that contains the **ECI Host Loader**. This embedded loader ensures that only a certified firmware and **ECI Host Loader** can be installed and launched. The **ECI Host Loader** is then able to verify and load valid **ECI Hosts**. The **ECI Host** software includes the **ECI Client Loader**, which then upon request can verify and load **ECI Clients**. The **ECI** loaders with the related security facilities are specified in ETSI GS ECI 001-3 [2]. The CPE may include loaders for other system software which is not relevant for **ECI** functionalities and has no relationship to the security related elements of the system.

During its installation in its **ECI Container** as well as during its launch, the **ECI Client** is informed by the **ECI Host** about its facilities, such as recording facilities, UHD facilities, a smart card reader, fingerprinting and watermarking facilities, and networks, as well as compliance with the framework specification and API versions.

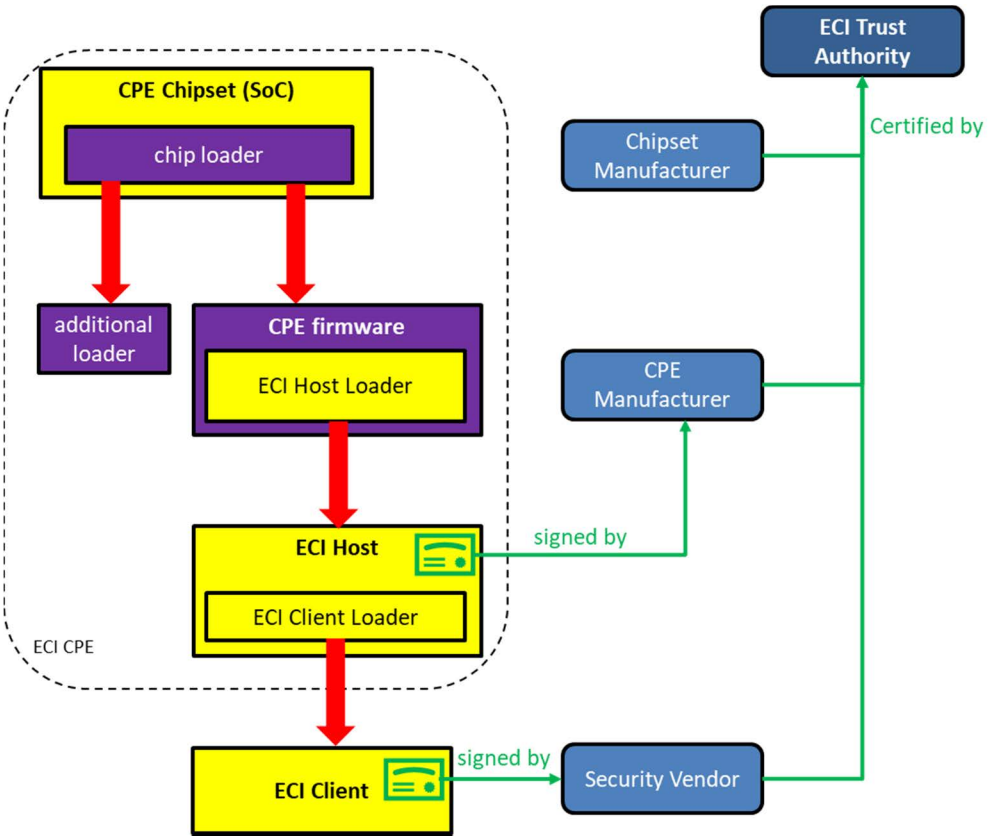


Figure 3: Hierarchical Loader Concept

4.10 Revocation

The **ECI** loader concept combined with the certificate based **Trust Environment** allows a flexible and targeted way of revoking **Entities** if this is deemed necessary, e.g. in case of a security issue. This means that the issuer of a particular certificate can revoke that particular certificate and have the revocation enforced through the **ECI** specific system of revocation lists managed by the **Trust Authority**. This allows the revocation of **ECI Client** versions, specific or ranges of **ECI Host** versions, specific manufacturers, and other **Entities** within the **ECI Ecosystem**. In addition, content providers and operators may exclude specific CPEs from their service distribution by blacklisting their unique device keys. The methods used allow other operators and content distributors to continue their services to these CPEs if they wish to do so.

Revocation can block all services from the operator or content provider to the CPE(s) concerned, or to a subset of services and is specified in ETSI GS ECI 001-3 [2]. This is subject of the functionality of the relevant CA or DRM system and out of the scope of the present document.

5 Trust Environment

5.1 General principles

In order to be able to establish a system based on **Embedded CI**, a **Trust Environment** has to be set up. Details about the **Trust Environment** are out of scope of the **ECI** specifications. However, the principles, which are specified in ETSI GS ECI 001-6 [6], are essential in order to fully understand how **ECI** works.

Trust Authority (TA) is an organization governing all rules and regulations that apply to implementations of the **ECI Architecture.** The **Trust Authority** needs to be impartial to all stakeholders in an **ECI Ecosystem**. This includes:

- CPE manufacturers

- Security Vendors which provide **ECI Clients**
- Chipset manufacturers, whose components include unchangeable Secure Processor keys and certificates, which are necessary for interaction between Host and the compliant CA/DRM system
- Platform operators; the platform operator is the party who controls all necessary elements of a CA/DRM system. Platform operators are for example service providers or network operators

An optional **Trusted Third Party (TTP)** may serve as a technical service provider, which issues certificates and keys to compliant manufacturers of the relevant components of an **ECI**-System on behalf of the **TA**. The trust of these keys and certificates is assured by the **Trust Authority**, which holds the root of trust.

Trust Authority and **Trusted Third Party** form the basis for the chain of trust and thus have to be involved in the entire processes ranging from production (chips and CPEs), over operations (secure **ECI Client** download and activation) to control measures (e.g. revocation).

The **Trust Authority** as a legal entity ensures the functioning of the **Trust Environment** via a contractual framework or license agreement, under which the various parties involved can assume their responsibilities and liabilities. Under the license agreement **Trust Authority/Trusted Third Party** are issuing certificates, test credentials and various IDs.

A **Trust Authority** establishes trust between all market participants for its targeted footprint. It is not recommended that a second **TA** becomes active in the same environment, as this would fragment that market and destroy the CA/DRM interoperability. However, there could be multiple **TA**s, e.g. per country or per region. If multiple **Trust Authorities** exists in parallel it is strongly recommended that **TA** A and **TA** B trust each to allow devices registered in **TA** A to be used in the domain of **TA** B.

5.1 Necessary operational workflows

This clause gives a first overview of the necessary operational workflows, which serve the needs of the different market participants and stakeholders in order to implement a business based on the **ECI** technology. Furthermore the indicated workflows are based on the essential technical elements which are necessary for implementation of an **ECI Ecosystem**. Figure 4 shows those interactions between those technical components and the relevant market participants.

NOTE: The description is generic and is not intended to reflect any existing proprietary solution or any actual running standardization activity.

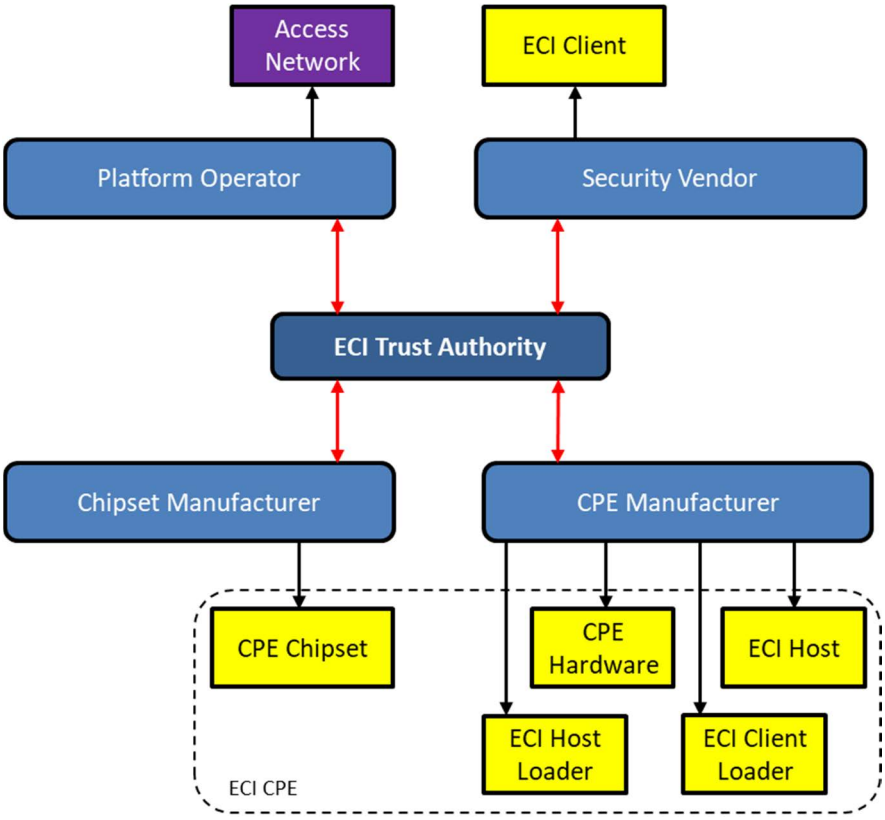


Figure 4: Necessary trust management between Trust Authority and the relevant stakeholders in a Trust Environment

The operational and related contractual issues (see red arrows in figure 4) for the **Trust Environment** are:

1) Integrity

Integrity means the requirement that one stakeholder is able to verify whether a hardware/software component provided by another stakeholder has not been modified by any unauthorized party and is fulfilling the specifications and robustness rules. This requirement can be fulfilled by suitable credentials and signatures and testing procedures based on test credentials provided by the **Trust Authority**/**Trusted Third Party**.

2) Authenticity

Authenticity means that any hardware/software component which originates from a contract partner of the **Trust Authority** and which has passed the necessary verification and certification steps can clearly be associated with the contract partner and thereby distinguished from any cloned component. Authenticity of any relevant hardware/software component is proven by any **ECI Ecosystem**.

3) Contractual Framework

The contractual framework established by the **Trust Authority** as a legal entity includes a compliance and robustness regime, and certification procedures in order to provide the environment for the establishment of an **ECI Ecosystem**.

4) Remedies

In case hardware/software components of an **ECI** system are no longer compliant, the **Trust Authority** establishes procedures for the provider of that component, targeting to re-establish the integrity of the **ECI Ecosystem** in a reasonable timeframe.

Essential technical components (yellow boxes in figure 4) are:

1) CPE chipset

The CPE chipset is the main component within CPE hardware which usually has included SoC ("System on Chip") due to existing requirements of platform operators and content providers. Furthermore usually the chip loader is included in the CPE chip.

2) CPE hardware

The secure CPE chipset implementation, prevention of any unauthorized access to storage elements (Flash, ROM), and protection of Interfaces are essential issues.

3) ECI Host

The **ECI Host** has manifold interactions with the **ECI Client** and all relevant CPE hardware interfaces. Security is ensured by detailed specifications and appropriate compliance and robustness rules.

4) ECI Client

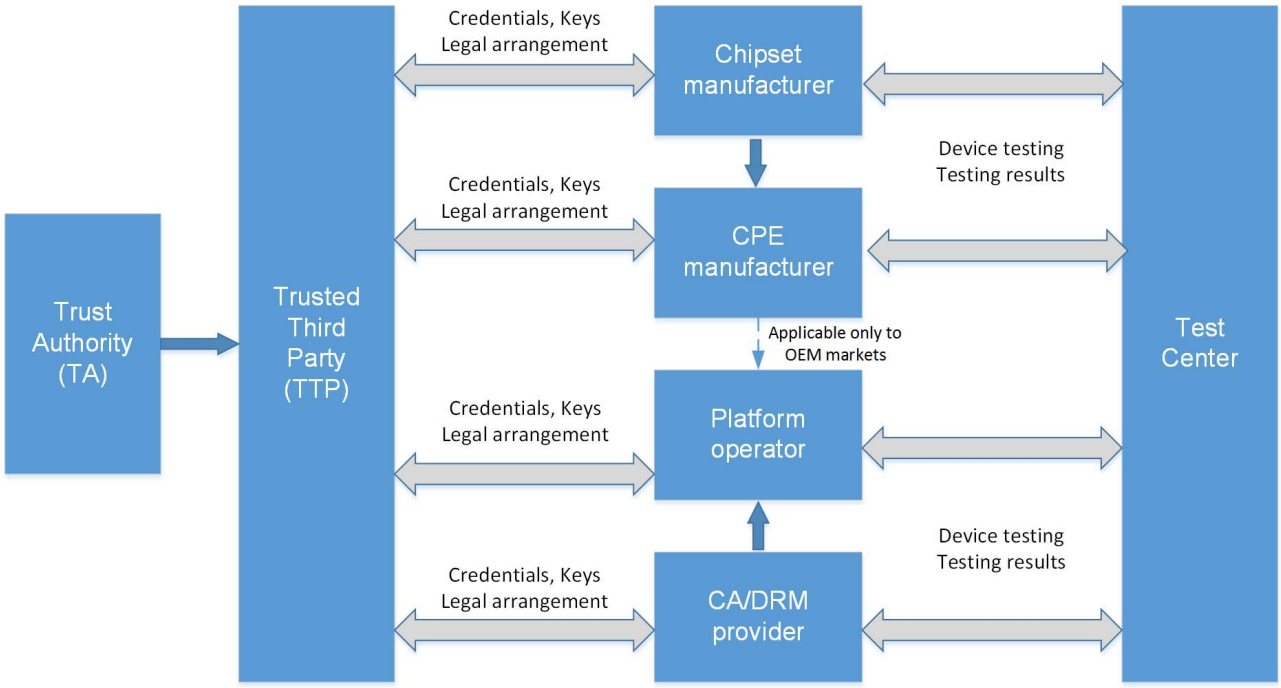
The **ECI Client** extracts all CA and DRM related information delivered by the frontends of the CPE and initiates the corresponding settings within the CPE device (descrambler, interfaces), which obviously needs close and secure interaction with the **ECI Host**.

5) ECI Client and **Host Loaders**

Different loaders allow the verification and secure loading of certified **ECI Hosts** or **ECI Clients**. The loaders make use of the security mechanism provided by the CPE to verify **ECI** software and enforce revocation.

Annex A (informative): Implementation of an **ECI**-compliant Trust Environment

This annex gives an exemplary overview of the operational workflows, which serve the needs of the different market participants in order to implement a business based on the **ECI** technology. Furthermore the indicated workflows are based on the essential technical elements which are necessary for implementation of an **ECI** system. Figure 4 in clause 5.1 shows those interactions between those technical components and the relevant market participants.



NOTE: **Trusted Third Party** (TTP) and Test Centre are contract partners of the **Trust Authority** (TA) for certification and key issuing process.

Figure A.1: General workflow overview

Contractual Framework

Secure trust management can only be carried out under a clearly defined contractual framework, in which the license agreement constitutes the core element. The **TA** provides license agreements to anyone seeking to implement the specification(s), be they CPE manufacturers, CA/DRM system vendors, chip manufacturers, other technology providers, platform operators, etc.

Therefore the license agreement is the essential instrument for the **TA** to create, maintain and make available to the horizontal market a secure but user friendly method to receive and get operative all required keys and other relevant security related material and information when connecting CPEs to providers of choice, as far as allowed conform the relevant usage rules. Similarly, the license agreement framework enables the **TA** to take proper care of revocation of all security material when a consumer is disconnected by the provider, as far as technically and economically possible.

The license agreement enables the coordinated and consistent application of the other elements of the contractual framework such as the technical specification, compliance and robustness rules, obligations & liabilities, testing & certification, implementation guidelines, etc.

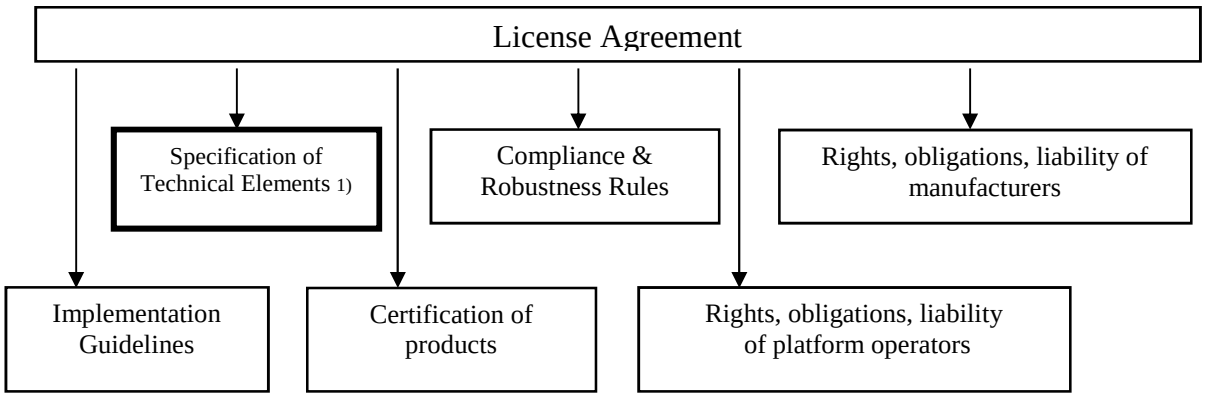


Figure A.2: Example for the components of a license agreement

1) Developed in the ETSI ISG ECI as a suite of Group Specifications.

Annex B (informative): Bibliography

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History

Document history		
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