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TECHNICAL REPORT

Configurable car infotainment services (CCIS) – Part 4: Protocol

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CONFIGURABLE CAR INFOTAINMENT SERVICES (CCIS) –

Part 4: Protocol

FOREWORD

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IEC TR 63246 has been prepared by the technical area 17: Multimedia systems and equipment for vehicles, of IEC technical committee 100: Audio, video and multimedia systems and equipment. It is a Technical Report.

The text of this Technical Report is based on the following documents:

Draft	Report on voting
100/3638/DTR	100/3823/RVDTR

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this Technical Report is English.

A list of all parts in the IEC 63246 series, published under the general title *Configurable car infotainment services (CCIS)*, can be found on the IEC website.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

INTRODUCTION

The market for car infotainment services (also known as "in-vehicle infotainment systems") has been growing rapidly, as reflected by the growth of the associated industries. It is expected that a variety of car infotainment (or multimedia) devices and services will be developed in the future. Such devices include navigation, cameras, speakers, headrest displays, air-conditioners, thermometers, heated seats, and lights. It is also expected that some devices will be developed to provide 4-dimensional experiences for users.

Car infotainment systems typically include A/V features (such as standard radio and CD players), and two-way communications tools, as well as hands-free phone connections, vehicle voice commands, and other types of interactive audios or videos. Car infotainment systems have evolved to allow passengers to watch movies and other visual media (for example, DVD players installed on the rear seats). Another distinctive feature of future car infotainment systems is mobile device connectivity. Newer vehicles provide a wide range of systems that allow devices (e.g. smartphones and laptops) to be connected to a variety of services embedded in the vehicle.

From this observation, there is a crucial need for standardization to provide car infotainment users with more enhanced services so as to easily manage and control infotainment devices as well as content within a car.

The purpose of the IEC 63246 series is to specify the general considerations, requirements, framework, and protocols to provide car users with the functionality of managing and controlling device and content resources within a car.

The IEC 63246 series consists of the following parts:

– Part 1: General;
– Part 2: Requirements;
– Part 3: Framework; and
– Part 4: Protocol.

IEC 63246-1 describes the general considerations of CCIS, which includes the CCIS system model and the types of CCIS users with the associated service flows.

IEC 63246-2 describes the requirements for CCIS, which include the CCIS functional entities, the communication model, and the functional requirements.

IEC 63246-3 describes the CCIS framework, which includes the information flows between functional entities and the CCIS operations, such as registration, device monitoring and control, and data transfer.

IEC 63246-4 describes the CCIS protocol, which includes the protocol messages and parameters, protocol procedures, implementation guidelines, etc.

CONFIGURABLE CAR INFOTAINMENT SERVICES (CCIS) –

Part 4: Protocol

1 Scope

This part of IEC 63246 describes the CCIS protocol, which includes the protocol messages, parameters and procedures performed by protocol entities. This part is informative; its intent is to provide information that can be considered in order to implement the CCIS protocol.

2 Normative references

The following document is referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 63246-1, *Configurable Car Infotainment Services (CCIS) – Part 1: General*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 63246-1 apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at https://www.electropedia.org/
- ISO Online browsing platform: available at https://www.iso.org/obp

4 General

The CCIS services are provided in collaboration with the protocol entities: CCIS users, CCIS master, and CCIS devices. CCIS master manages and controls the CCIS services by interaction with CCIS users and devices. CCIS devices can support multimedia contents for CCIS services.

To provide CCIS services, a set of CCIS functional operations are performed by the protocol entities, which include registration, authentication, device control, device monitoring, profile management, and content delivery. These functional operation flows are described in IEC 63246-3. This document describes the protocol for CCIS services (represented as the CCIS protocol), which are based on the other parts of CCIS (IEC 63246-1, IEC 63246-2 and IEC 63246-3).

Figure 1 describes a reference protocol stack for CCIS among the protocol entities. The CCIS protocol is an application-layer protocol that can be used to provide the CCIS services. The well-known Transmission Control Protocol (TCP) and Internet Protocol (IP) can be used as the underlying protocol for delivery of CCIS messages in the networks. Any other transport protocol can be used for delivery of CCIS messages, instead of TCP/IP. For example, a low-power CCIS device can use its own dedicated protocol for message delivery, or it can deliver the CCIS message by using the lower-layer protocol, without using the TCP/IP protocols. As for the lower-layer protocols, any kinds of Medium Access Control (MAC) and Physical layer protocol (PHY) can be used, which can typically include the IEEE 802.11 Wireless Local Area Network (WLAN) and the IEEE 802.15 Wireless Personal Area Network (WPAN) technologies.

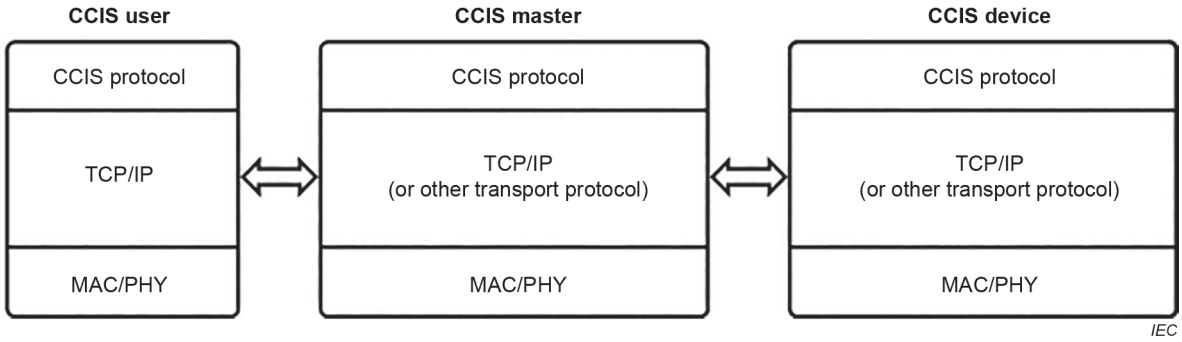

Figure 1 – Protocol stack for CCIS

This Technical Report describes information that can be referred to for implementation of the CCIS protocol. The CCIS protocol or its implementation can depend on the choice of the CCIS service providers.

This Technical Report specifies the CCIS protocol that is an application-layer protocol used to provide CCIS services between the CCIS user and the CCIS master, or between the CCIS master and CCIS devices. For this purpose, the messages for the CCIS protocol are described in Clause 5, which includes the message format, the types of messages, and the parameters associated with the messages. Based on the messages, the protocol procedures are described in Clause 6, which includes the protocol operations that will be performed by each protocol entity: user, master, and device. The overall operational flows for CCIS operations are described in IEC 63246-3.

5 Message

5.1 Message format

5.1.1 General

Each CCIS protocol message consists of the 12-byte header and the data payload of variable length, as shown in Figure 2. The 12-byte header consists of the following fields: version (4 bits), message type (12 bits), payload length (16 bits), sequence number (32 bits), and cookie (32 bits).

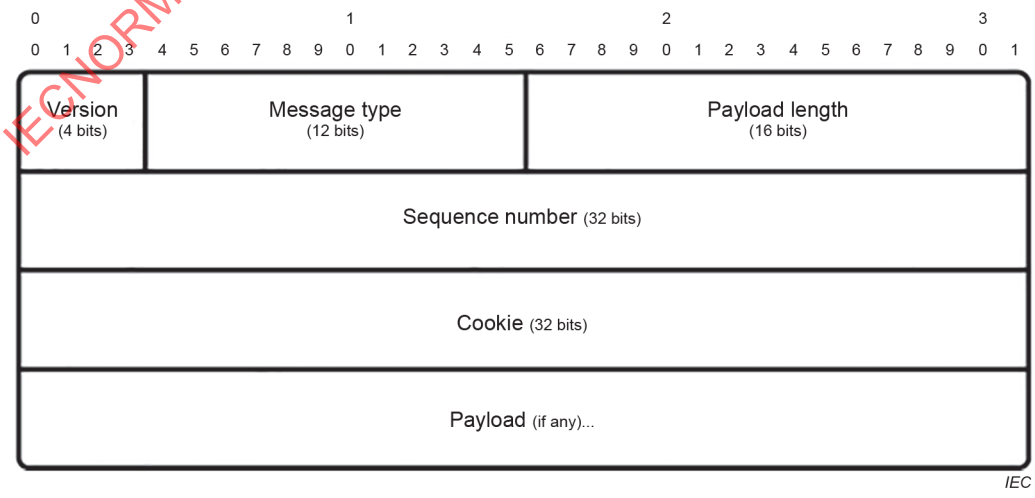

Figure 2 – Message format of CCIS protocol

5.1.2 Version

A 4-bit unsigned integer is used to indicate the version number of this CCIS protocol. The current version of this specification shall be set to 1 (0x01). Other values are reserved for future use.

5.1.3 Message type

A 12-bit unsigned integer is used to indicate the type of this message, which is described in 5.2.

5.1.4 Payload length

A 16-bit unsigned integer is used to indicate the length (in byte) of the payload contained in this message, except the 12-byte header.

5.1.5 Sequence number

A 32-bit unsigned integer is used to indicate the sequence number of this message. This field can be used to detect the message loss or duplication during message transmission. This field initially begins with 1 and increases by 1, whenever a new message is generated. When the sequence number reaches $2^{32} - 1$, its subsequent sequence value will be 0.

5.1.6 Cookie

A 32-bit unsigned integer is used to indicate a cookie. This cookie information is used to determine whether a pair of messages corresponds to the same transaction flow (request-response). For example, a request message and its corresponding response message must have the same cookie value. A cookie value (other than 0) is randomly generated by the requester of the concerned messages.

The cookie value 0 represents that no response is needed for the requesting message. For example, the periodically or repeatedly messages can have the cookie value of 0.

5.1.7 Payload

This variable-length field is used to represent the data payload information, which depends on the message type.

5.2 Message type

5.2.1 Format

The message type is determined by combination the three 4-bit subfields: service, class, and operation. Figure 3 shows the format of message type.

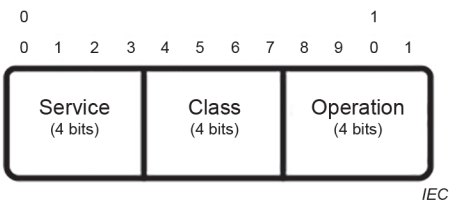

Figure 3 – Format of message type field

5.2.2 Service

The service field, a 4-bit unsigned integer, is used to represent the associated service operations: broadcasting (0), authentication and certification (1), client registration (2), device registration (3), device control (4), device monitoring (5), or content delivery (6).

Table 1 shows the service value currently defined in this specification. The remaining values ranging from 7 to 15 are reserved for future use.

Table 1 – Services indicated by message type

Services	Value
Broadcasting	0
Authentication and certification	1
Client registration	2
Device registration	3
Device monitoring	4
Device control	5
Content delivery	6
Reserved	7 to 15

5.2.3 Class

Table 2 shows the classes indicated by message type. In CCIS, the message types are classified into the five classes: request (0), notification (1), success response (2), client error response (4), and server error response (5). 'Request' indicates that the peer node should take an action as the response. 'Notification' indicates that this is just for information. 'Success response' indicates that the request is successfully processed. 'Client error response' and 'server error response' indicate that the request has not been processed successfully by the client or server, respectively. All the remaining class values are reserved for future use.

Table 2 – Classes indicated by message type

Class	Value
Request	0
Notification	1
Success Response	2
Reserved	3
Client Error Response	4
Server Error Response	5
Reserved	6 to 15

5.2.4 Operation

Table 3 shows the list of operations that are defined in this specification. An operation represents a specific action that will be considered by the receiver of this message. At present, the following four operations are defined: create (1), read (2), update (3), and delete (4). These operations are applied only to the request and success response classes among the classes of Table 2. The use of delete (4) is for further study. The remaining operation values (0, 5 to 15) are reserved for future use.

Table 3 – Operations indicated by message type

Operation	Value
Create	1
Read	2
Update	3
Delete	4
Reserved	0, 5 to 15

5.2.5 Types of CCIS messages

Table 4 shows the commonly used CCIS message types defined in the procedure introduced in IEC 63246-3.

Table 4 – Messages used for CCIS protocol

Message type	Type	Class	Operation	From	To
Broadcasting_Master_Information	0	1	1	Master	All
Certification_Information_Request	1	0	1 or 2	User	Master
Certification_Information_Response	1	2	1 or 2	Master	User
Authority_Check_Request	1	1	1	Master	Owner
Authority_Check_Response	1	0	3	Owner	Master
Authority_Check_Confirmation	1	2	3	Master	Owner
Client_Registration_Request	2	0	1	User	Master
Client_Registration_Response	2	2	1	Master	User
Device_Identity_Notification	3	0	1	Device	Master
Device_Discovery_Notification	3	1	1	Master	User
Device_Registration_Authentication	3	0	1	User	Master
Device_Registration_Request	0x03	0	2	Master	Device
Device_Registration_Response	0x03	2	2	Device	Master
Device_Registration_Confirmation	0x03	2	1	Master	User
Device_Status_Report	0x04	0	3	Device	Master
Device_Status_Request	0x04	0	2	User	Master
Device_Status_Response	0x04	2	2	Master	User
Device_Status_Query	0x04	0	2	Master	Device
Device_Occupation_Request	0x05	0	2	User	Master
Device_Occupation_Response	0x05	2	2	Master	User
Device_Control_Request	0x05	0	3	User	Master
Device_Control_Transmission	0x05	0	3	Master	Device
Device_Control_Confirmation	0x05	2	3	Device	Master
Device_Control_Response	0x05	2	3	Master	User
Content_Delivery_Request	0x06	0	1 or 2	User	Master
Content_Delivery_Notification	0x06	0	1 or 2	Master	Device
Content_Delivery_Confirmation	0x06	2	1 or 2	Device	Master
Content_Delivery_Response	0x06	2	1 or 2	Master	User

6 Parameters

6.1 General

Each message can be associated with the specific parameters that are referred to in the protocol operations. This clause describes the parameters associated with the messages used for each protocol operation. These parameters can be inserted into the data payload field of the CCIS message.

6.2 Broadcasting – Broadcasting_Master_Information

The CCIS master periodically broadcasts its identification information to all CCIS devices and users. This message contains one property.

- master-identifier: Unique identification string of the CCIS master

6.3 Authority and Certification

6.3.1 General

Table 5 shows the parameters associated with the messages used for authority and certification.

Table 5 – Messages and parameters for authority and certification

Message type	Parameter
Certification_Information_Request	identifier
	certification_key
Certification_Information_Response	access-token
	life-time
Authority_Check_Request	client-identifier
	permission
Authority_Check_Response	authority-result
	access-token

6.3.2 Certification_Information_Request

In CCIS, the devices and the users certificated by the CCIS master can use the services. The CCIS devices and users that have been registered with the CCIS master can request a certification through Certification_Information_Request message with the operation value of 2, which includes the following parameters:

- identifier: identification string of the CCIS device or user for certification;
- certification-key: encryption key string shared with the CCIS master during registration.

Public clients who want to use the CCIS service can be temporarily certificated through Certification_Information_Request with the operation value of 1, which includes the following parameter:

- identifier: Identification string of public client for certification.

6.3.3 Certification_Information_Response

Upon receiving the request, the CCIS master responds with a Certification_Information_Response, including the validity period of the access-token and the access-token. This indicates that it has been authenticated if the received information is valid.

- access-token: a string that verify the CCIS device is certificated;
- life-time: a number indicating access-token valid time in seconds

6.3.4 Authority_Check_Request

On receiving a service request from a CCIS client, the CCIS master checks whether the user has the appropriate authority. If not, the CCIS master transmits the Authority_Check_Request to the CCIS owner to obtain the permission. This message contains the following two properties:

- client-identifier: identification string of the user who requested to use the CCIS service;
- permission: level of authority that the user wants to acquire.

6.3.5 Authority_Check_Response

On reception of Authority_Check_Request, the CCIS owner responds to the CCIS master with Authority_Check_Response, which includes the following parameter:

- authority-result: a Boolean value indicating whether the permission is granted (true: permission, false: denial);
- access-token: the access-token of the owner for the permission.

6.3.6 Authority_Check_Confirmation

In response to Authority_Check_Response, the Authority_Check_Confirmation message is delivered from the CCIS master to the CCIS owner, which includes the indication of success response. No parameters are used.

6.4 Client registration

6.4.1 General

Table 6 shows the parameters associated with the messages used for client registration.

Table 6 – Messages and parameters for client registration

Message type	Parameter
Client_Registration_Request	identifier
	certification_key
	permission
	alive-time

6.4.2 Client_Registration_Request

Temporary Owners and Private Users can receive CCIS services only after registered with the CCIS master. Each CCIS user, who wants to register with CCIS master, transmits the Client_Registration_Request message, including the following parameters:

- client-identifier: unique string to identify the CCIS client in the system;
- certification-key: encryption key shared with CCIS master for certification process;
- permission: a number indicating the permission (temporary owner is represented by 1 and private client by 2);
- alive-time: a string indicating the expiration date of the user registration. The format is "mm-dd-yyyy".

6.4.3 Client_Registration_Response

Upon completion of registration, the CCIS master transmits Client_Registration_Response including successful registration to the CCIS client. Success or failure can be checked through the code in the header, and no parameters are used.

6.5 Device registration

6.5.1 General

Table 7 shows the parameters associated with the messages used for device registration.

Table 7 – Messages and parameters for device registration

Message type	Parameter
Device_Identity_Notification	device-information
	permission
	master-identifier
Device_Discovery_Notification	device-information
	permission
Device_Registration_Authentication	authentication-result
	access-token
Device_Registration_Request	device-identifier
	certification-key
	access-token
	life-time
Device_Registration_Response	resources
Device_Registration_Confirmation	device-identifier

6.5.2 Device_Identity_Notification

The CCIS device, which has received the broadcast message from the CCIS master, transmits a Device_Identity_Notification message including the following parameters:

- device-information: a string that represents the device;
- permission: a number indicating permission level required by the user for use of service;
- master-identifier: a string obtained from the broadcast message of CCIS master.

6.5.3 Device_Discovery_Notification

After receiving the information of the unregistered CCIS device, the CCIS master transmits the Device_Discovery_Notification message including the following parameters:

- device-information: device information obtained from Device_Identity_Notification;
- permission: permissions required by users.

6.5.4 Device_Registration_Authentication

The CCIS owner transmits the Device_Registration_Authentication message to the CCIS master. This message contains the following parameters:

- authentication-result: a Boolean value indicating the result of the approval (true for permission, false for denial);
- access-token: a string value to verify that it is the owner.

6.5.5 Device_Registration_Request

The CCIS master, which has obtained the registration permission from the CCIS owner, transmits Device_Registration_Request to the CCIS device to obtain detailed information required for registration. This message includes the following parameters:

- device-identifier: unique string generated by the CCIS master to identify the CCIS device;
- certification-key: encryption key issued by the CCIS master for certification of the registered CCIS device;
- access-token: a string to verify that the CCIS device is certificated;
- life-time: a number representing the validity time of the access-token in seconds.

6.5.6 Device_Registration_Response

On receiving the registration permission from the CCIS master, the CCIS device transmits the Device_Registration_Response message to the CCIS master to deliver its information. This message includes an array of resources (e.g. power, temperature, and air conditioner mode, etc.), and each resource includes the following parameters:

- resource-identifier: a number that uniquely identifies the resource;
- resource-name: string to help CCIS users easily identify resources;
- resource-type: string indicating the type of resource value. Values such as "number", "string", and "Boolean" can be set in this field;
- resource-value: a current value of the resource;
- resource-value-min: a minimum value that the resource value can take;
- resource-value-max: a maximum value that the resource value can take.

6.5.7 Device_Registration_Confirmation

Upon receiving the result of the registration request from the CCIS device, the CCIS master transmits Device_Registration_Confirmation to inform the CCIS owner of the registration result. This message can include the following parameter:

- device-identifier: a string of identifier of CCIS device.

6.6 Device monitoring

6.6.1 General

Table 8 shows the parameters associated with the messages used for device monitoring.

Table 8 – Messages and parameters for device monitoring

Message type	Parameter
Device_Status_Report	resource-identifier
	resource-value
Device_Status_Request	access-token
	device-identifier
	resource-identifier
Device_Status_Response	resource-value

6.6.2 Device_Status_Report

In order for the CCIS master to know the status of the CCIS device, each CCIS device transmits the Device_Status_Report message to the CCIS master. Device_Status_Report message can be periodically transmitted by each device or can be transmitted when a resource status is changed. This message includes the following parameters:

- resource-identifier: a number identifying the resource;
- resource-value: the current values of the corresponding resource.

6.6.3 Device_Status_Request

The Device_Status_Request message is issued by a CCIS user to obtain a specific resource value of a CCIS device. This message contains the following parameters:

- access-token: a string to verify that the message is from a certificated user;
- device-identifier: CCIS device identification string with the resource of interest;
- resource-identifier: identification string of the resource of interest.

6.6.4 Device_Status_Response

On receiving Device_Status_Request, the CCIS master responds with Device_Status_Response containing the up-to-date information of the device resource value as follows:

- resource-value: the values of the resource requested by the user.

6.6.5 Device_Status_Query

The CCIS master can ask if there is any change in the CCIS device by transmitting Device_Status_Query to the CCIS device. This message does not contain any parameters.

6.7 Device control

6.7.1 General

Table 9 shows the parameters associated with the messages used for device control.

Table 9 – Messages and parameters for device control

Message type	Parameter
Device_Occupation_Request	device-identifier
	access-token
Device_Occupation_Response	resources
Device_Control_Request	device-identifier
	resource-identifier
	resource-value
	access-token
Device_Control_Transmission	resource-identifier
	resource-value
Device_Control_Confirmation	resource-identifier
	resource-value
Device_Control_Response	device-identifier
	resource-identifier
	resource-value

6.7.2 Device_Occupation_Request

CCIS clients who want to control the CCIS device need to occupy the CCIS device before using the services. For this purpose, CCIS client can send Device_Occupation_Request to CCIS master. This message has the following parameters:

- device-identifier: CCIS device identification string to be occupied by CCIS clients;
- access-token: a string to verify that the message is from a certificated user.

6.7.3 Device_Occupation_Response

Upon receiving the Device_Occupation_Request message, the CCIS master performs the authority check. After the authority check process is successfully done, the CCIS master sends the Device_Occupation_Response to the CCIS client, which includes the resource information:

- Resources: an array of the resources associated with the CCIS device.

6.7.4 Device_Control_Request

In CCIS device control, the resource value of CCIS device can be changed. For this purpose, a CCIS client transmits Device_Control_Request to the CCIS master to change the resource value of the occupied CCIS device. This message includes the following parameters:

- device-identifier: a string identifying the occupied CCIS device;
- resource-identifier: a string identifying the resource which is to be changed;
- resource-value: the value of the resource to be changed;
- access-token: a string to verify that the message is from a specific user.

6.7.5 Device_Control_Transmission

When the CCIS master receives the CCIS device control request from the CCIS client, it will send the Device_Control_Transmission message to the CCIS device. This message contains the following parameters:

- resource-identifier: a string identifying the resource to be changed;
- resource-value: the values of the resource to be changed.

6.7.6 Device_Control_Confirmation

On reception of Device_Control_Transmission, the CCIS device checks whether the received control request is valid and changes the resource value if it is valid. After that, the CCIS device transmits Device_Control_Confirmation including the changed results to the CCIS master. This message contains the following parameters:

- resource-identifier: a string identifying the resource that was changed;
- resource-value: the values of the resource that was changed.

6.7.7 Device_Control_Response

On receiving Device_Control_Confirmation, the CCIS master sends Device_Control_Response to the concerned CCIS client. This message contains the following parameters:

- device-identifier: identification string of the concerned CCIS device;
- resource-identifier: identification string of the concerned resource;
- resource-value: the changed values of the concerned resource.

6.8 Content delivery

6.8.1 General

Table 10 shows the parameters associated with the messages used for content delivery.

Table 10 – Messages and parameters for content delivery

Message type	Parameter
Contents_Delivery_Request	access-token
	device-identifier
	content-type
	content-length
	resource-identifier
Contents_Delivery_Notification	content-type
	content-length
	resource-identifier
Contents_Delivery_Confirmation	resource-identifier
	content-type
	content-length
Contents_Delivery_Response	resource-identifier
	content-type
	content-length

6.8.2 Contents_Delivery_Request

The CCIS users who want to exchange a large volume of multimedia data contents with CCIS devices, transmit Contents_Delivery_Request to the CCIS master. If a CCIS client wants to send (upload) the content to the CCIS device, the operation field of the message header is set to 1, whereas if a CCIS client wants to receive (download) the content, the operation field is set to 2.

This message contains the following parameter, when the operation field is set to 1:

- access-token: string for access permission;
- device-identifier: CCIS device identification string;
- content-type: media resource type to be transmitted;
- content-length: media resource size to be transmitted.

This message contains the following parameter, when the operation field is set to 2:

- access-token: string for access permission;
- device-identifier: CCIS device identification string;
- resource-identifier: content identification string that CCIS user wants to get.

6.8.3 Contents_Delivery_Notification

On receiving a request from the CCIS client, the CCIS master transmits the concerned CCIS device the Contents_Delivery_Notification message, after appropriate authority check of the requesting CCIS client. The parameters of this message are the same with those of the Contents_Delivery_Request message.

6.8.4 Contents_Delivery_Confirmation

On receiving the Contents_Delivery_Notification message from the CCIS master, the CCIS device transmits the Contents_Delivery_Confirmation message to the CCIS master, after performing the resource transmission or preparation of resource reception. In the successful case, this message has the message type of class 2 and operation 1 (in response to the message with class 0 and operation 1), or class 2 and operation 2 (in response to the message with class 0 and operation 2). The parameters of this message are the same with those of the Contents_Delivery_Request message.

6.8.5 Contents_Delivery_Response

Upon receiving the Content_Delivery_Confirmation message from the CCIS device, the CCIS master transmits the Content_Delivery_Response to the CCIS user. The parameters of this message are the same as those of the Contents_Delivery_Request message.

7 Procedures

7.1 General

IEC 63246-3 (CCIS framework) describes the functional operations for CCIS services, which include the client/device registration, device monitoring/control, content delivery, etc. Clause 7 describes the protocol procedures to be performed by each protocol entity, such as the CCIS user, the CCIS device, and the CCIS master.

7.2 CCIS user

Figure 4 shows the state transition diagram of the CCIS user. CCIS users can start from different states, according to the CCIS user type. Car owners and temporary owners can use the service after receiving broadcast messages from the CCIS master. Private clients can use the service after being registered with the CCIS master with the CCIS owner's permission. Public clients can use the limited services only after the certification process.

In Figure 4, CCIS users in the "certificated" state can use services (e.g. device control, content delivery, and device monitoring). The detailed description on the state transition for the services is given in 7.4.

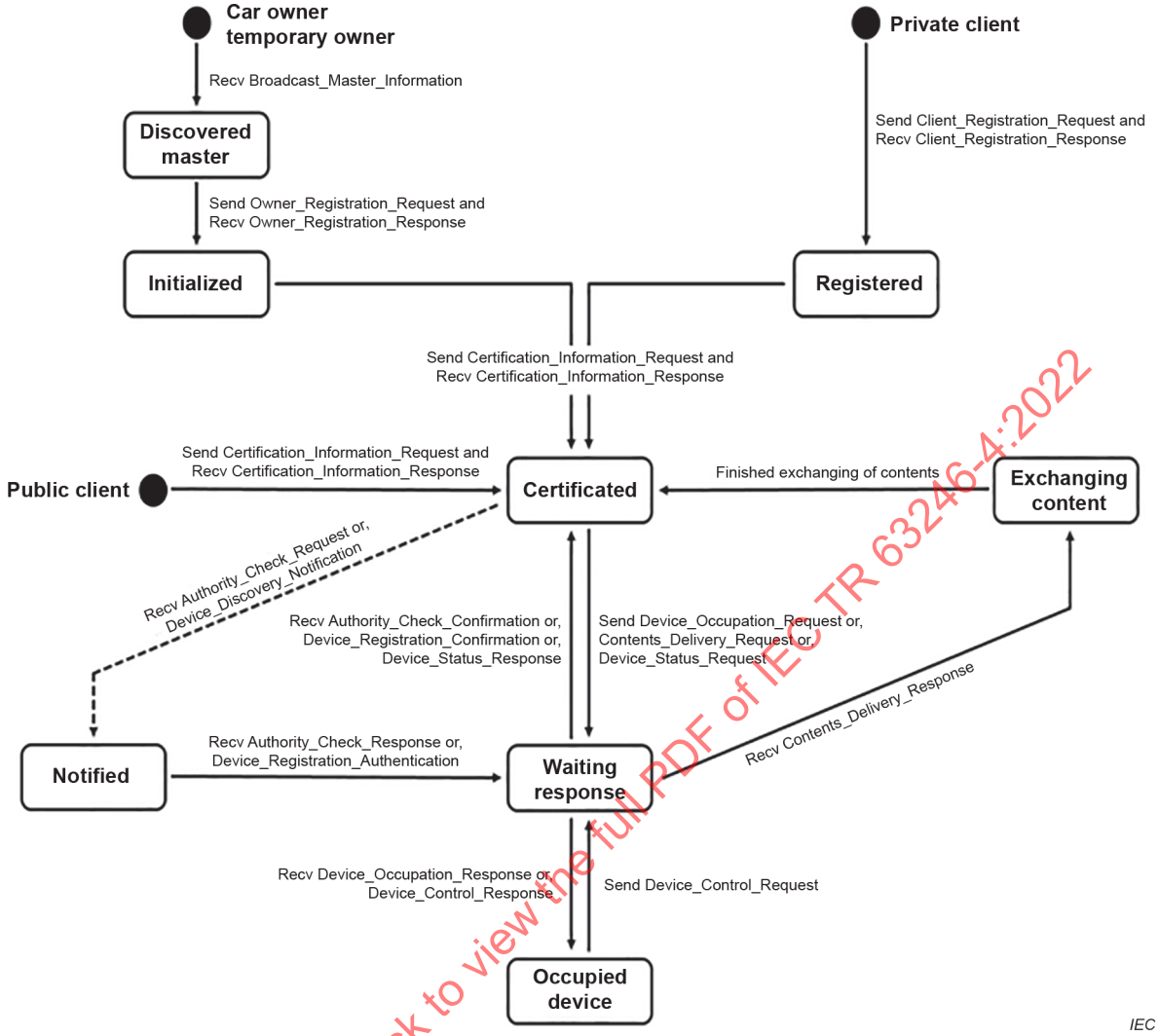

Figure 4 – State transitions of CCIS users

7.3 CCIS device

Figure 5 shows the state transitions of a CCIS device to perform the CCIS operations, in which the seven states are defined. The detailed description on the state transition for the services is given in 7.4.

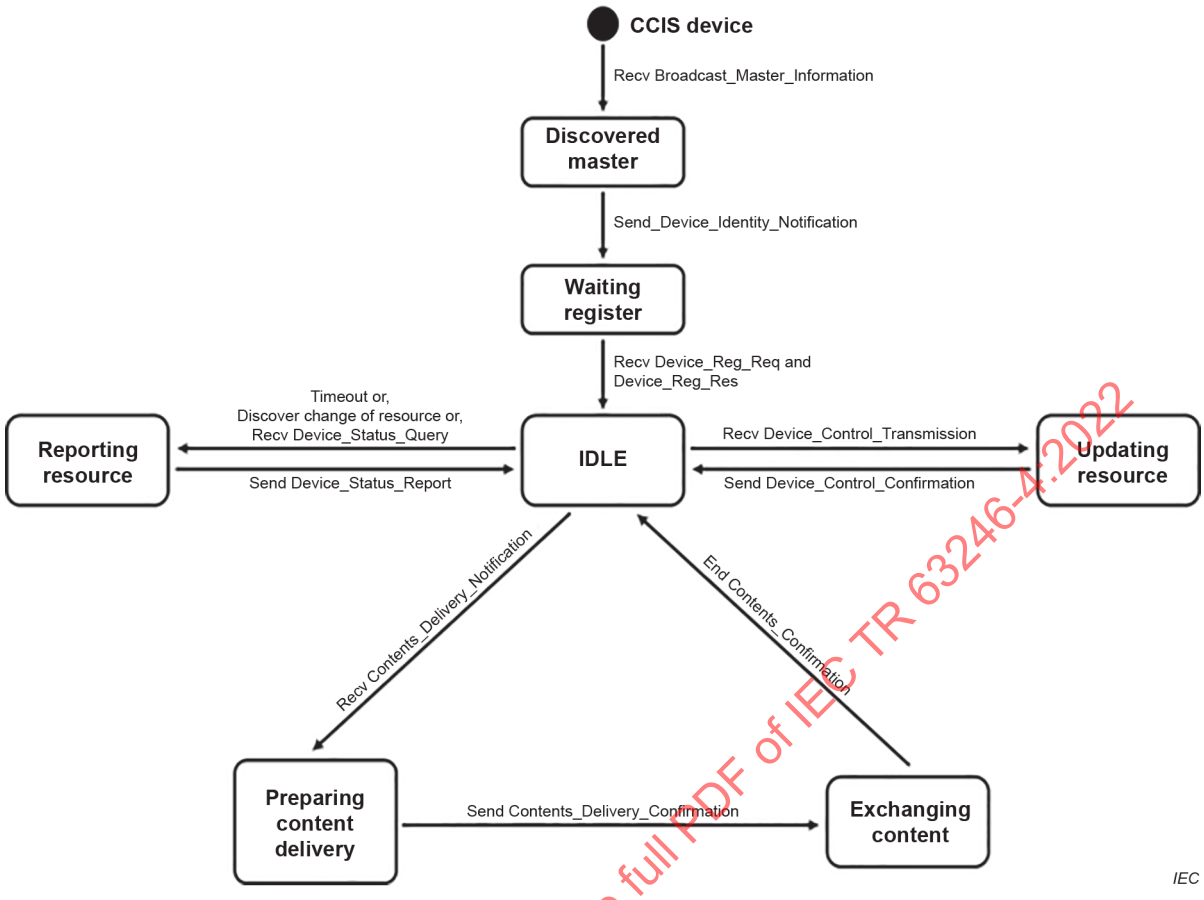

Figure 5 – State transitions of CCIS device

7.4 CCIS master

7.4.1 Initialization

Figure 6 shows the state transitions of the CCIS master in the initialization process. The CCIS master performs initialization before going into the "idle" state in which it can exchange messages for service provision. Car owners are registered with the CCIS master in the initialization process. The registration of car owners is outside the scope of this document. Temporary owners and the other users can join the services by interacting with the CCIS master that is in the "idle" state.

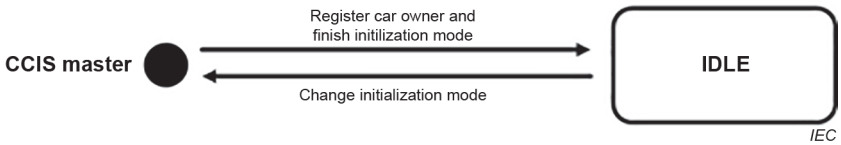

Figure 6 – State transition of CCIS master in initialization process

7.4.2 Client registration and certification

Figure 7 shows the states of the CCIS master during client registration and certification.

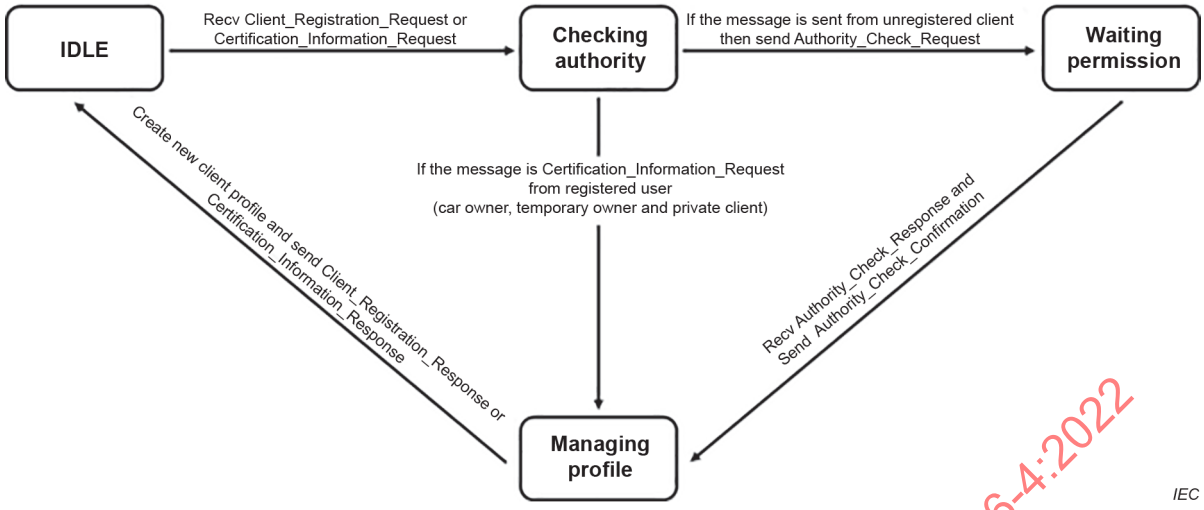

Figure 7 – States transitions of CCIS master in client registration and certification

When the CCIS master in the "idle" state receives a Client_Registration_Request or Certification_Information_Request from a user, it becomes the "checking authority". In this state, the CCIS master checks the service type of the transmitted message and the user's authority. If the message is transmitted from an unregistered client, the CCIS master transmits Authority_Check_Request to the car owner to obtain authority, and then it goes into the "waiting permission" state. When the permission of the car owner is obtained, the state is changed to "managing profile" and the profile of the client is updated.

In the checking authority state, if the CCIS master receives a Certification_Information_Request message from a registered user, it goes into the "managing profile" state without obtaining permission. In the "managing profile" state, the CCIS master registers a new client or issues an access_token to be used temporarily by the CCIS user. After that, the CCIS master transmits Client_Registration_Response or Certification_Information_Response to the user, and then it goes into the "idle" state. At this time, the client receiving the Client_Registration_Response becomes "registered" state, and the user receiving the Certification_Information_Response becomes "certificated" state.

7.4.3 Device registration

Figure 8 shows the states of CCIS master in device registration.

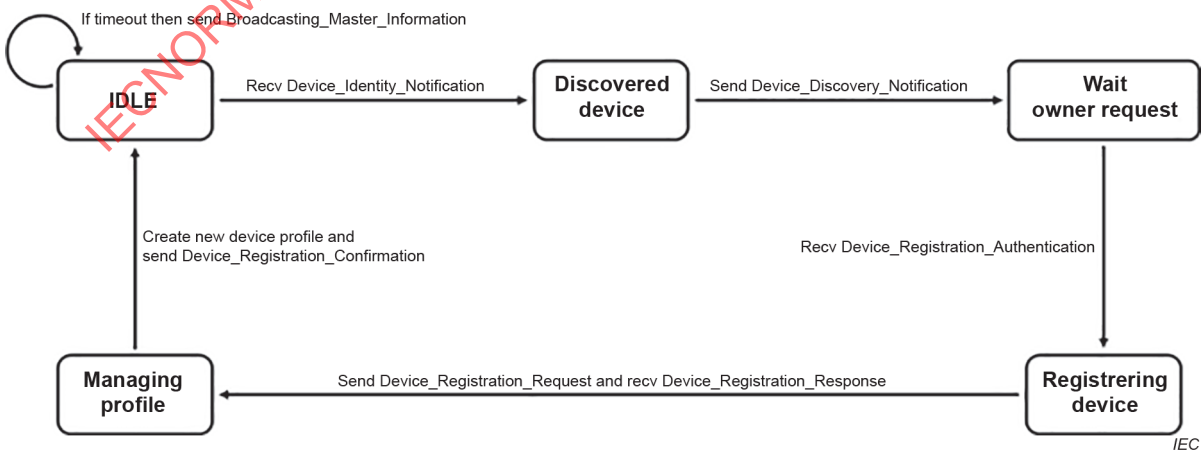

Figure 8 – State transitions of CCIS master in device registration