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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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THE CONCEPTUAL MODEL OF STANDARDIZATION FOR MULTIMEDIA CAR SYSTEMS AND EQUIPMENT

FOREWORD

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IEC TR 6XXXX, which is a technical report, has been prepared by IEC technical committee 100: Audio, video and multimedia systems and equipment.

The text of this technical report is based on the following documents:

Enquiry draft	Report on voting
XX/XX/DTR	XX/XX/RVC

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

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

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- withdrawn,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

The National Committees are requested to note that for this publication the stability date is 2020.

THIS TEXT IS INCLUDED FOR THE INFORMATION OF THE NATIONAL COMMITTEES AND WILL BE DELETED AT THE PUBLICATION STAGE.

INTRODUCTION

This Technical Report is initiated by the study session 5 in TC 100/AGS and made by stage 0 project, PT100-9. The study session 5 was formed to study car related issues of TC100, the study session 5 proposed stage 0 project, it was approved and assigned as PT100-9.

The equipment and systems under the scope of TC 100 are firstly used in residential domains such as in home, school, office, etc. And now these are used in mobile domains such as in car, train, airplane, ships and with individuals as movable, carryable or wearable device. These new domains require the different specification than the conventional residential domains.

PT100-9 focuses on the car domain. At first, this Technical Report clarifies the conceptual model of car related issues under the scope of TC100, and then the details are described to understand the standardization items of car related issues under the scope of TC 100.

THE CONCEPTUAL MODEL OF STANDARDIZATION FOR MULTIMEDIA CAR SYSTEMS AND EQUIPMENT

1 Scope

This Technical Report specifies the conceptual model of multimedia systems and equipment which is utilized for car, this model describes possible standardization items.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC/TR 61998 ed1.0 (1999), *Model and framework for standardization in multimedia equipment and systems*

IEC/TS 62045-1 ed1.0 (2006-12), *Multimedia security - Guideline for privacy protection of equipment and systems in and out of use - Part 1: General*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
car main AV system
main audio video and multimedia system installed in car

3.2
car working and functional mode
mode of various car's working and function

3.3
UX mirroring
user experience mirroring

3.4
picture navigation
car navigation with geotagged pictures

3.5
smart device
a mobile computing device with communication function

3.6
smart car
a car with computing and communication functions, interfaces, and sensors to provide advanced user interface and user experience

4 Overview of the car system

The TC100 system model from the point of data communication, it is described in Figure 1. Whether the application area is car, home or any kind of domain, this model is applicable. The TC 100 system model of car basically uses this model as audio video and multimedia systems and equipment, and infotainment system.

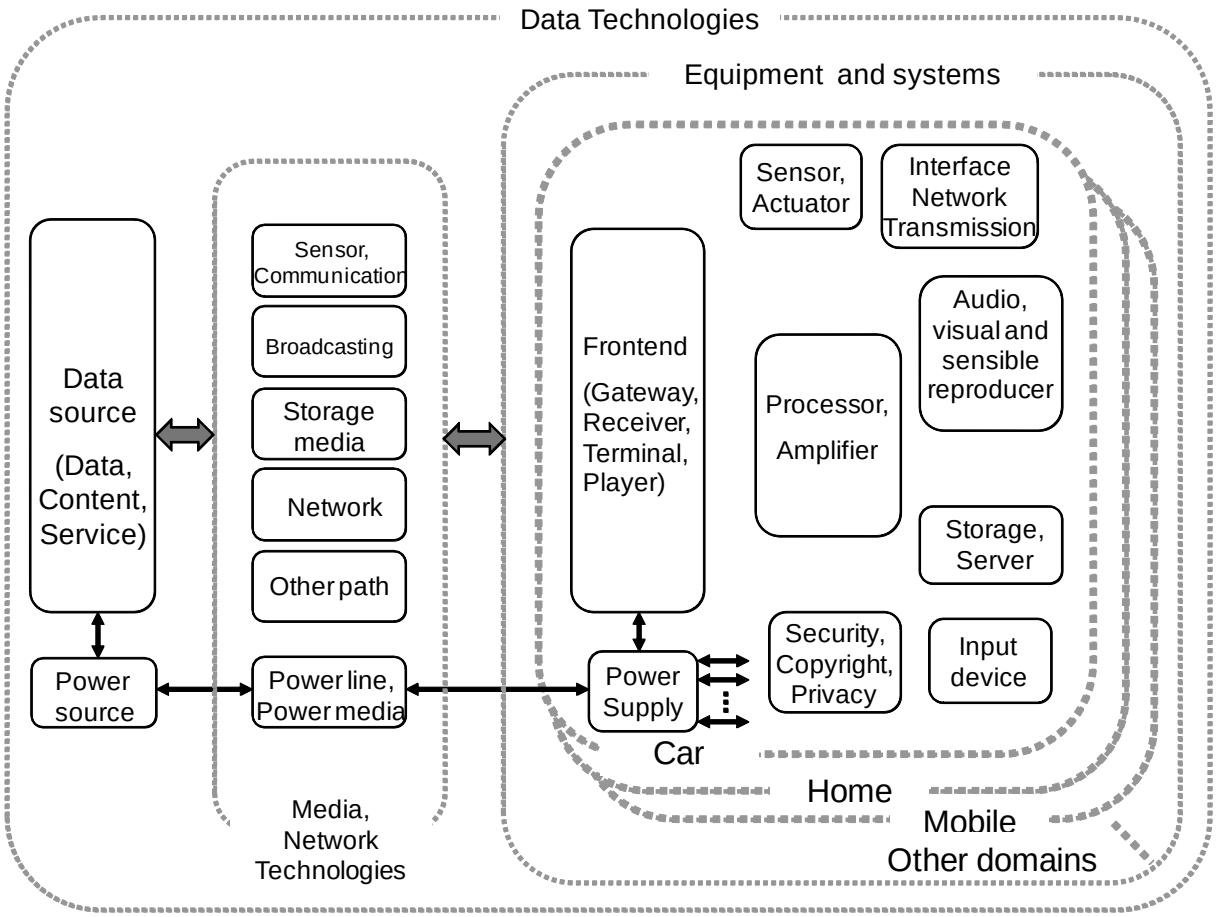


Figure 1 – TC100 system model by data communication

The communication model between the system and user is described in Figure 2. This is TC 100 model and it is applied to car. The user is driver, passenger, and pedestrian in car domain and users in other domains.

The communication between TC 100 models is described in Figure 3. This communication is between, TC 100 model via user and TC 100 model, TC 100 model via user and TC 100 model via use, and TC 100 model and TC 100 model.

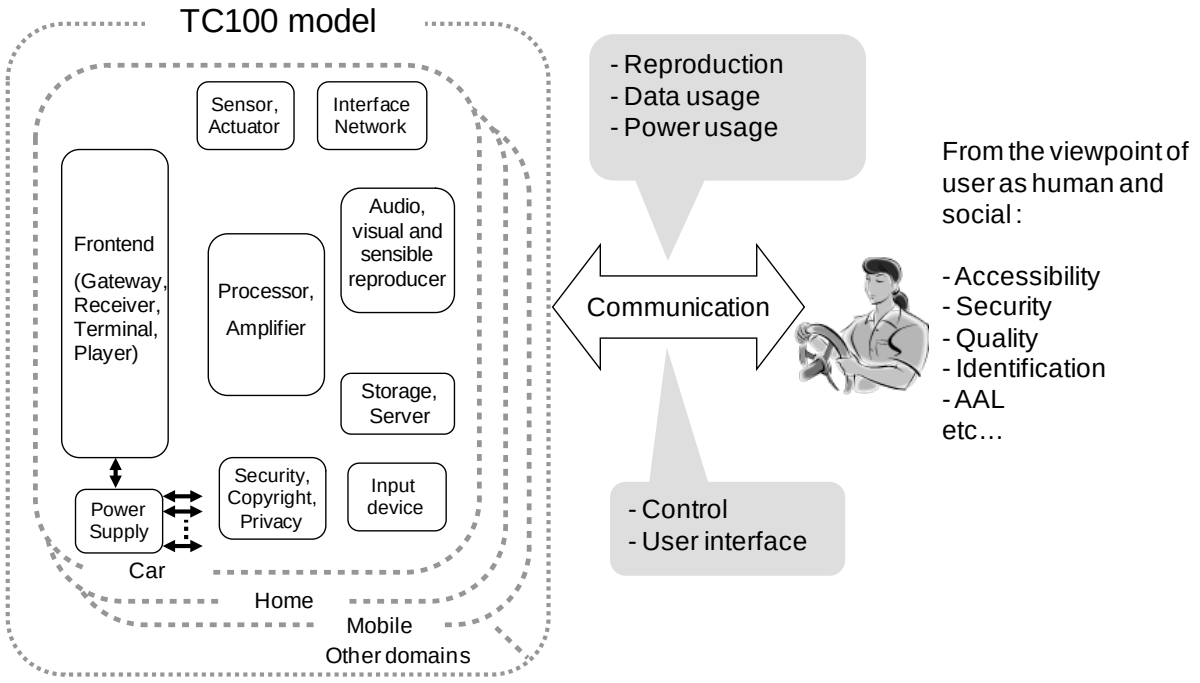


Figure 2 – User communication model

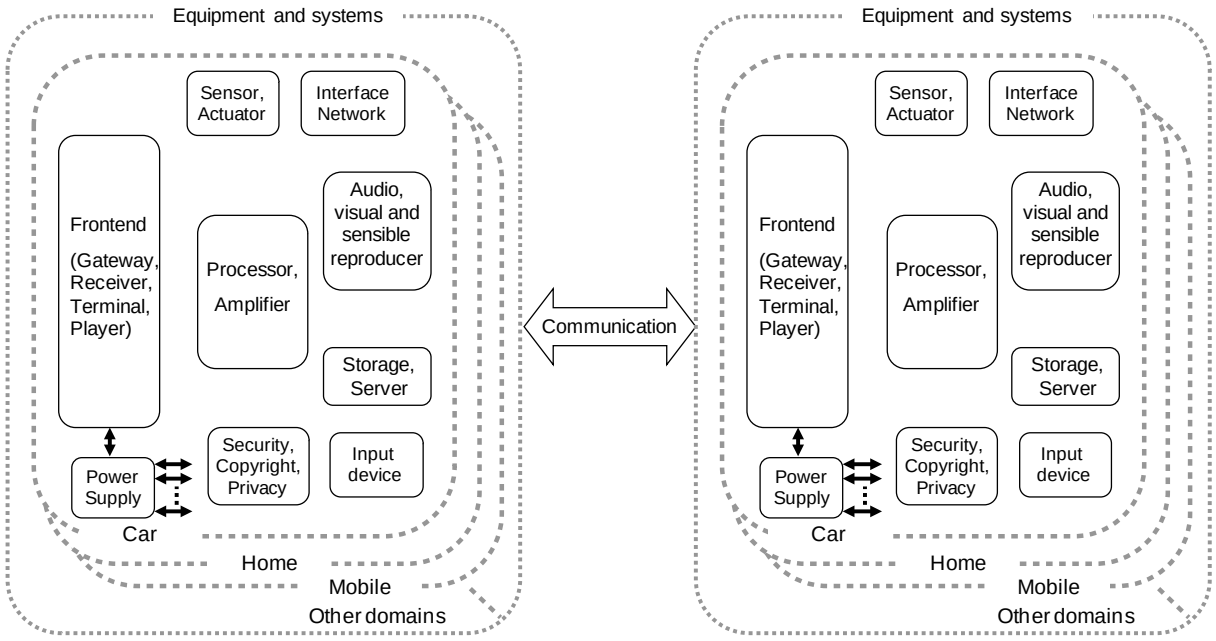
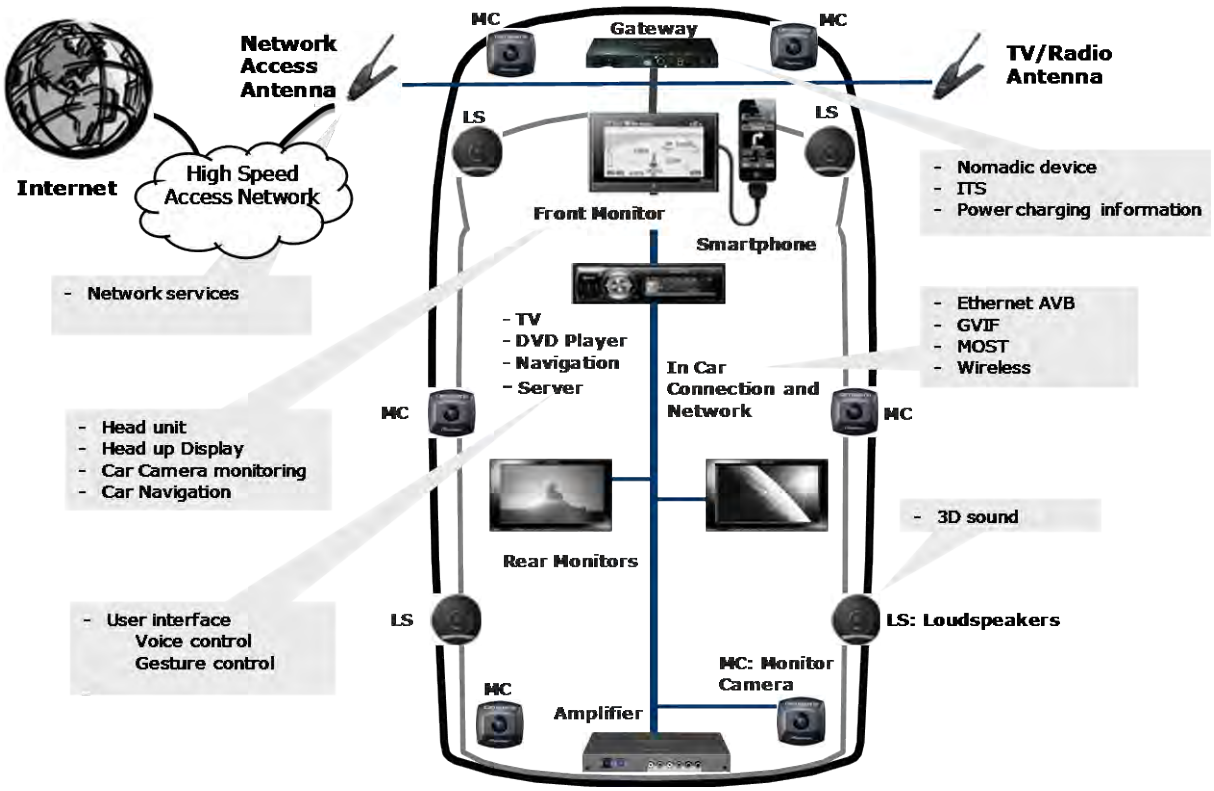


Figure 3 – Communication between TC100 models

For the car system model, an example of more concrete model is described in Figure 4.



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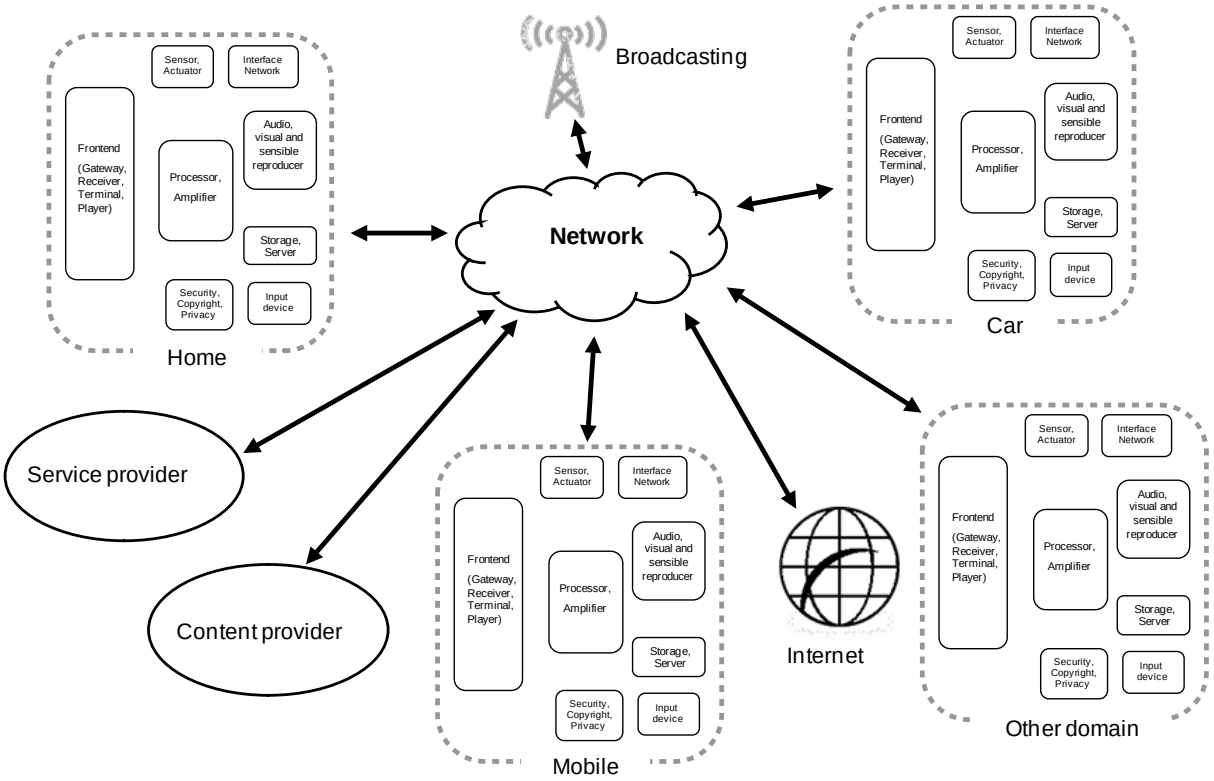
248 **Figure 4 – Car model**

249 The car system, the home system and the mobile system are related each other with network
250 communication and services, it is described in Figure 5.



251

252 **Figure 5 – Networked systems**

5 Use case

5.1 General

As the one of TC100 system, the car system has the similar use case to the home system use case. The different aspect is that the car system is movable on road and land, and autonomous. The use case should take the following characteristics of car system into account;

- movable and autonomous, self energy supply,
- various car working and functional modes of the car main AV system depending on the condition of car such as drive, cruise, stop, park and refuel or charge,
- human users are driver, passenger, pedestrian in and around car, and remote users from car,
- users remote form car are other human, non human such as TC100 model over the network.

The car working and functional mode is particular to the car system, the car main AV system and each device have a specific function and specification depending on that mode. Each mode has its function and specification relating to the condition of car. The mode will shifts to other modes depending on the condition of car.

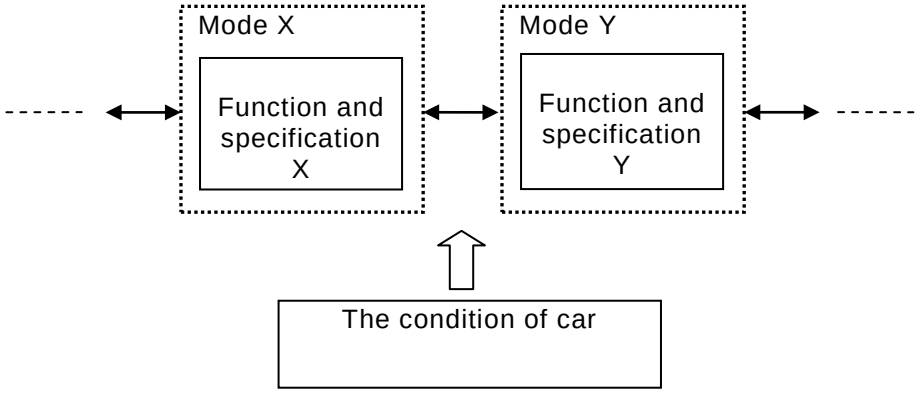


Figure 6 – Modes

For instance, using e-mail in each mode is done as follows,

– when car is stopping, all function of e-mail is available for driver,

– when car is driving, some restricted function is available for diver's safety, as text-to-speech to read e-mail, speech-to-text to send e-mail, or only e-mail notification on display device,

– when car is at rest, e-mail is stored and forwarded to other if necessary,

– when some urgent event is happed, alert e-mail is sent automatically.

Any other infotainment and services have the similar mode dependent function and specification.

5.2 Use experience system

5.2.1 General

Use experience system provides user integrated services and experiences. This system consists of mixture of other systems.

5.2.2 Smart start

Users can remotely control infotainment or audio visual system with a smart device before getting in a car, also if accessing to the CAN and car control system, user can adjust temperature inside a car, unlock (or lock) car doors, or start a car.

5.2.3 UX mirroring

UX mirroring is one of user-convenient functions provided by smart devices including a smart car, and provides users with personalized experience (UX) such as reorganizing or reordering user interfaces and relevant contents by sharing a user's personal preference and usage information in advance among them.

Once a smart car is connected to the user's smart device via wireless communications such as Bluetooth or Wi-Fi, the user can choose to start UX mirroring service. Then a personalized menu screen is displayed on a display device of a smart car based on the usage pattern of the smart device. For example, icons for frequently used application appear bigger.

5.2.4 Data synchronization

Smart devices and a smart car can synchronize in real time various user data including navigation system setting, time schedule, and so on.

5.3 Infotainment system

5.3.1 General

Infotainment system is adoption of any of information service that is online and offline, such as e-mail, web, social network, information services and any Internet services.

The function and specification of infotainment system have various modes depending on car working and functional mode and users. The mode will shift to the other mode as it is required and needed by user or other.

5.3.2 Picture navigation

Picture navigation is an infotainment service that allows users to find location with geotagged pictures, which contain latitude and longitude coordinates of the place where they are taken. The location can be set as a point of departure or destination.

5.3.3 Car office system

5.3.3.1 Under-light office

Users make a list of tasks with the estimated time. Office system will let them implement tasks whose estimated time is short while they wait traffic signals.

5.3.4 Car social network

Communication among cars can give users the opportunity to exchange traffic information such as car speed, traffic accidents and congestion ahead. A smart car can gather (or get) such information by experience (or by other smart cars running on the opposite lane). This

information can be visualized on a display device, or verbalized, or given in other optimized ways for users.

5.3.5 Panoramic vision

360-degree panoramic view around a smart car can be reconstructed from video images from cameras installed around a smart car, which helps users see blind spots easily and drive more safely.

5.3.6 OBD-based car maintenance service

On-board diagnostics (OBD) systems give users access to the status of various vehicle sub-systems through their smart device. Users can manage their cars on their own.

5.4 Navigation system

5.4.1 General

Navigation is a guidance system for user/driver to drive or live in the car, it is a useful or necessary information system. The information system consists of each information is described as follows. Combination of any of this information provides the navigation system.

5.4.2 Surrounding information

The surrounding information around car is visual, audio, atmospheres such as temperature, air pressure and geographical information of road and land.

For instance, surround visual monitor provides the view around the car, it has the same various function and specification modes. This is not function as mirror dose but provides user visual information as infotainment.

Other sensors also provide surrounding information with the same various function and specification modes.

All of these information can be used for car navigation including auto driving support.

5.4.3 Geographical information

The position of car is one of the factor of navigation, it is provided by GPS, gyrocompass, and network system.

5.4.4 Drive information

This information is a history and plan or foresee of car diving on the geographical map. User drives a car with this information of navigation system, this assists drive and user/driver. This has the same various function and specification modes.

5.4.5 Car information

This information is condition and the status of car that is such as temperature, humidity, speed and fuel status of the car system. The atmosphere in the car can be informed by TC 100 model but the information of the car system exists inside the car system. If the secure gateway to CAN allows assess, TC 100 model can get information.

This information can be monitored over network by other user.

5.4.6 Event information

Event means various status change of car that is caused by incident on car from outside and inside, such as change of acceleration, turning on/off light and outside weather affect. These

are recognized by sensor or car control system, this information can be used to trigger shifting car working and functional mode.

5.5 Audio Visual entertainment system

5.5.1 General

This is the same as home system, in addition the function and specification mode is applied.

5.5.2 3D audio system

The inside of a car is suitable for 3D audio. This characteristic is applied to listen music and also it can provide effective notification sound.

5.5.3 Emotional service

5.5.3.1 Emotion-based music streaming

A smart car can recommend users listening to a series of songs selected based on their emotion, which can be sensed by measuring heart rate or something from their wearable device.

5.6 Parking concierge system

When a smart car enters a parking lot where advanced beacon system providing indoor positioning function is equipped with, an application program on the smart car starts automatically and displays a map of the parking lot with empty parking slots highlighted on a display device in a smart car. After the user finishes parking, the application program stores the location and shares it with user's smart device.

5.7 Car monitoring system

Though users are away from their smart cars after parking, they can watch what is happening around their cars through their smart device connected to a black box installed in a smart car. Users can also get various types of alarm messages from their smart car.

5.8 Self-emergency call system

In the case that a user gets severely injured from a traffic accident, a smart car can make a self-emergency call for rescue. In order to do that, a smart car can sense the degree of collision and check the user's status.

6 Networked system

6.1 General

The car system is networked as described in Figure 5. With this networked system, the car system acts as an integrated system with other car system, home system, mobile system and network services.

6.2 Network inside of car

6.2.1 Car status information

The electric and electronic system of car has its own information, which is mainly information regarding car control and driving. These car information are important information for safety and security of the car, they must be secured from outside access of the car. Car information is environment status information such as air condition and temperature, door status, window glass status, and driving status information such as speed, tire status. These car status

information may be accessible from outside if security and safety is guaranteed by such as secure gateway.

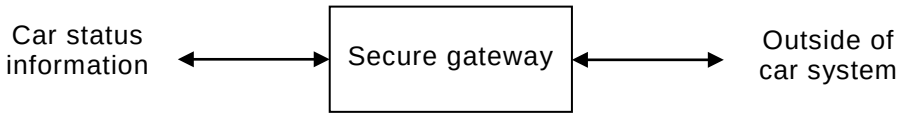


Figure 7 – Car status information

6.2.2 Infotainment system network

The network for infotainment system is used for various devices and equipment inside car. The network or interface is used for audio visual and information reproduction devices and it is also used for video, audio and other environment information of outside of car, inside of car and car itself, these information are networked or interfaced to the processor or any other devices.

For instance, sensors capture information regarding drive, e.g. view of car front, audio around car, acceleration information, and geographical information are networked. This information is monitored or recorded in car, also communicated to the network outside of car through gateway.

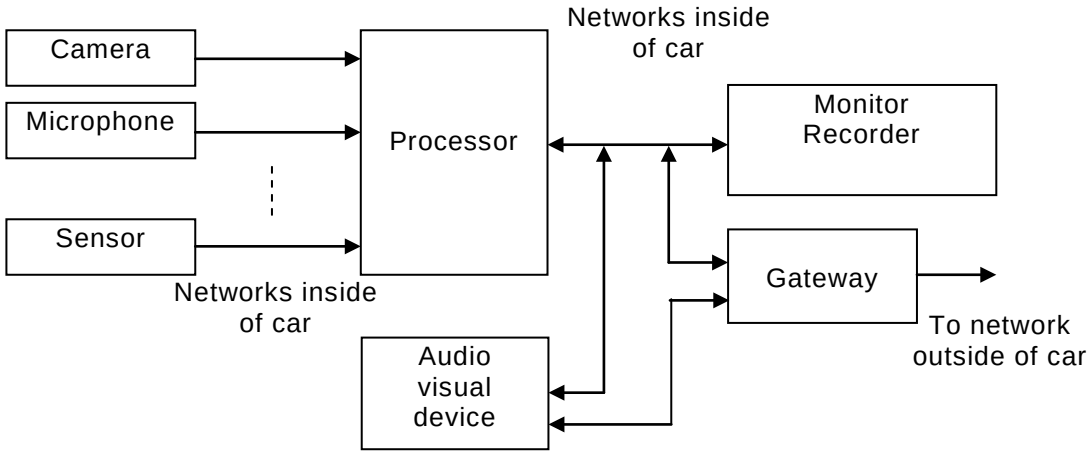


Figure 8 – Infotainment system network

The method of the network inside of car may be ether/LAN based network or any other dedicated networks, the network should have the ability to be applied to all kind of information and control inside car.

6.2.3 Network of devices

6.2.3.1 AV devices and smartphone

AV devices especially mobile devices and smartphone can be used inside car, these devices are connected to the car main AV system. Main device controls and uses these devices with more efficient controller and reproduction devices. The network and interface to the car main AV system may be dedicated one or any others existent one. The network used for smartphone is described in Annex A.

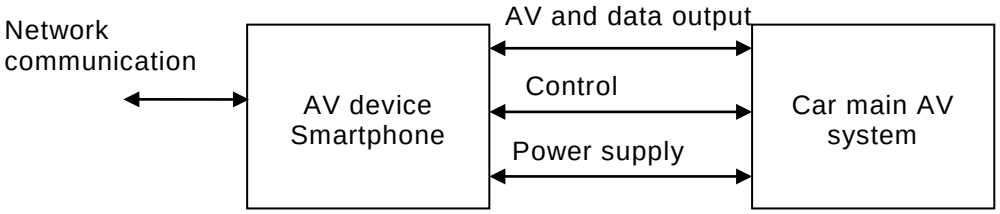


Figure 9 – AV devices

6.3 Network outside of car

6.3.1 General

The network may be IP based network, The data model, format and protocol needs car specific specification.

6.3.2 Network between car and car

Car to car communication is done by peer-to-peer and client-server system. One car's system and equipment communicates with other cars' system and equipment. This means a user of a car uses mutually other car's AV&IT resources.

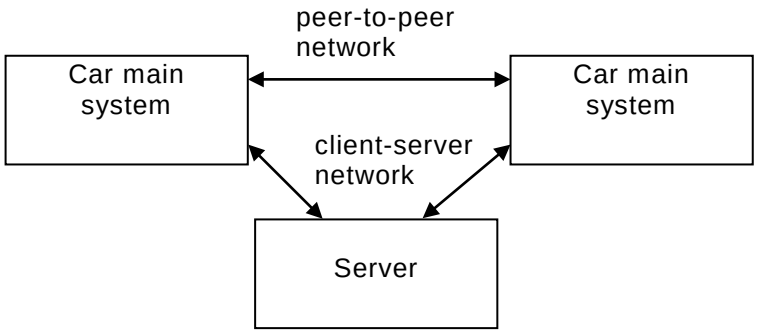


Figure 10 – Network between car and car

6.3.3 Network between car and other TC 100 system

Communication between car and TC 100 system is done by peer-to-peer and client-server. Car's system and equipment communicates with system and equipment in other TC 100 system.

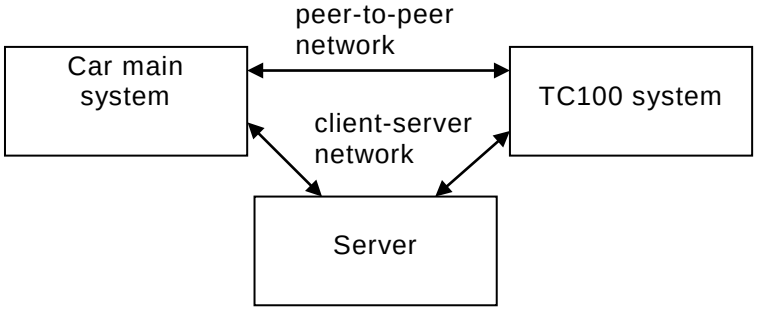


Figure 11 – Network between car and home

6.3.4 Network with cloud servers

Network with cloud is all other networks other than peer-to-peer networks. Any kind of services are applied to these networks, therefore there are many kind of data formats and protocols are applied. To use services among cars, the minimum compatibility should be considered.

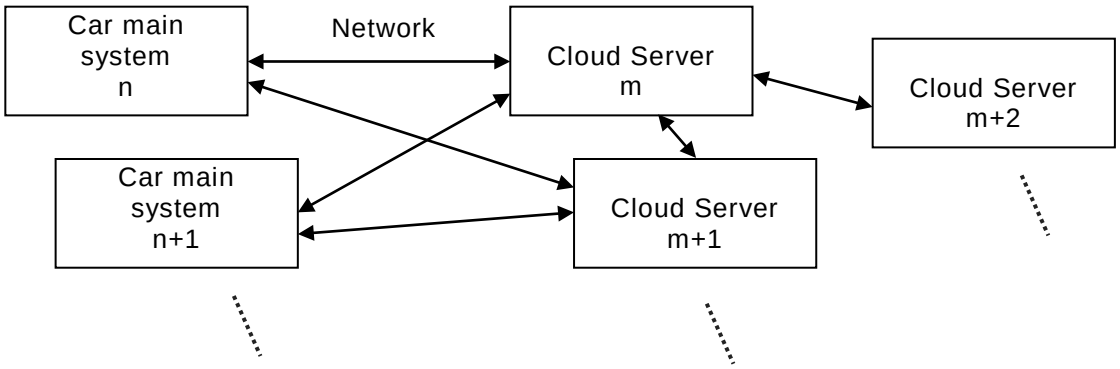


Figure 12 – Network with cloud

7 Elements

7.1 Device

7.1.1 Source device

Source device provides audio video and information data of content. It is dedicated device for car or not dedicated device which is loaded in car. The both devices are under the environmental condition of car, that is moving and under large range of circumstance parameters.

Car moving requires source devices tolerance to vibration and acceleration, large range of circumstance parameters are such as temperature range, humidity range and luminance range.

7.1.2 Sink device

Sink device receive content data and reproduce it. It is dedicated device for car or not dedicated device which is loaded in car.

The environmental conditions are the same as source deice, the requirement is the same.

7.1.3 Sensor

7.1.3.1 Camera and microphone

Audio and visual information are captured by camera and microphones for inside and outside of car.

7.1.3.2 Geographical sensor

Sensors can be used by car system which is moving to obtain geographic information of circumstances and other objects. Sensors are such as radar, GPS, Wi-Fi, and geomagnetic

sensor. The information from navigation system and signage system are used as sensor information.

7.1.3.3 Circumstance sensor

Sensors capture circumstance information of moving car, they are such as temperature, air pressure, luminance, and acceleration.

7.1.4 Output device

Audio visual reproduction devices and other reproduction devices provide information for human senses.

7.1.5 Car black box device

Car black box devices are necessary to record information such as video around the car.

7.1.6 Mobile and wearable device

Mobile, wearable and carryable device can be loaded in car and user can use them as interface/control and output/input device.

7.2 Network and interface

7.2.1 Inside of car

For multimedia car systems and equipment, all network and interface that are used for home system can be applied.

The interface between car control system and multimedia car systems and equipment should have a secure gateway to prevent interfering car control system.

7.2.2 Outside of car

For multimedia car systems and equipment, all network and interface that are used for home system can be applicable.

The gateway to outside of car is similar to home system. The security of gateway should be more improved than home system, the path from outside to car control system should be strictly inhibited.

7.3 Information

7.3.1 File format

All file formats that are used for home system can be applicable.

7.3.2 Metadata

All file formats with metadata that are used for home system can be applicable. In addition car system specific metadata is specified. It is caused because of car nature that is movable and autonomous. Autonomous system senses the outside world and moves, metadata regarding that nature is specified.

7.4 User interface device

7.4.1 General

Users as driver, passenger and pedestrian, they communicate with car system with interface device and systems.

543 **7.4.2 Audio reproduction device**

544 Loudspeaker is applied with optimization to the space of inside car, and to unbalanced
545 listener position.

546 **7.4.3 Video reproduction device**

547 **7.4.3.1 Monitor**

548 Monitor used for visual content is the same as home and mobile system used.

549 **7.4.3.2 HUD**

550 Head up display is used especially for car, there are the car glass attached type and the car
551 glass installed type.

552 **7.4.3.3 Display installed in car body**

553 Monitor can be a part of the car itself, front glass can be a display and the car body inside and
554 outside can be a display.

555 **7.4.4 Input device**

556 **7.4.4.1 Voice recognition**

557 Voice recognition is used in car. It should be considered that noisy environment and talker
558 reorganization.

559 **7.4.4.2 Gesture**

560 Gesture can be used in car as same as home or mobile system, it should be considered that it
561 does not affect driver's operation of car.

562 **7.4.5 Output device**

563 **7.4.5.1 Audio device**

564 Audio device is used as audible interface to user.

565 **7.4.5.2 Video device**

566 Not monitor but it is used as visual interface to user.

567 **7.4.5.3 Sensible device**

568 Any sensible device can be used as interface to user such as vibrator, heater, and scent
569 device.

570 **7.4.6 Wearable device**

571 Wearable devices are very close device to user, these can be used as output device and user
572 interface between car main AV system and user.

573 # 8 Measurement method

574 ## 8.1 General

575 The measurement method for car multimedia systems and equipment is basically the same as
576 home system, however some conditions that are specific for car environment should be

considered, these are such as conditions of wide range of temperature, vibration and luminance.

8.2 Audio video device

The method for audio video devices is the same as home system, in addition car circumstances such as vibration and acceleration, high and low temperature should be considered.

8.3 Sensor device

8.3.1 Camera

Camera device need to be measured under the wide range of light and luminance and other atmosphere conditions of car.

8.3.2 Other sensor

Other sensor devices need to be measured under the wide range of atmosphere conditions of car.

9 Content

9.1 General

Content used in car system is the same content as used in home system, in addition infotainment system needs car specific content in some cases.

9.2 Infotainment content

9.2.1 Map

Map content is specific for car system. Map content for car needs further information than the usual maps, they are information for car navigation and information of any kind of geography related information including such as signage and other infotainment information.

9.2.1.1 Map format

The format of map content for car needs functionalities for infotainment, there are many kind of information regarding car maps. Electric map formats are specified by ISO and other SDOs but the map and format for car infotainment needs to be clarified.

9.2.2 Traffic and road information

This information is provided by other system than TC 100 system, for instance ITS and telematics are the cases. Also any services of Internet can be used for TC 100 system including such kind of traffic and road information.

9.2.3 Drive information

Drive information is created by the car activities, such as view, sound and event information around car and inside car.

9.2.4 Network service information

Content and information from network services are the same as used in home system, in addition car specific content and information are provided.

9.2.5 Car maintenance information

OBD-II system provides various vehicle information such as fuel economy, driving habits, diagnostic trouble codes and so on.

9.3 AV content

This is the same as home system.

10 Security

10.1 General

There are two aspect of security about car. One aspect of security is data security, data of content and information in the car main AV system and equipment should be secured, that data include copyright, intellectual property and privacy. In general, TC100 guideline's security criteria and IEC 62045-1 can be applied to make the car main AV system and equipment secure. IEC 62227 can be applied to ensure the copyright information. IEC 62443 can be applied to be secure network. Any DRM method and copy control information can be applied.

Another aspect of security regarding car is that car and drive system have a responsibility for user's safety, the car main AV system should not affect that safety. The car main AV system may have a path to car and its drive system, data communication through that path should not affect car and drive system and should be secured.

10.2 Networked systems and equipment

Network inside and outside of the car is a path from outside of the car, these networks can be an intrusion path to the car and the drive system. This path is described in Figure 5, and also the paths described in Figure 1 as paths to data, content and service. This path should be secured.

Copyrighted content and private information are stored in the car main AV system, the system connected to outside such as home or cloud, the network and the car system should be secured to prevent unauthorized access to the content and information jn the car main AV system.

The outside networked system can access to the car main AV system through the network and even to the car driving system, this may caused serious danger for user as driver, passenger and pedestrian. This access from outside should be prevented and the system should be made to be secure against these accesses.

10.3 None networked system and equipment

None networked car main AV system has no path from outside trough network, but it has a path from outside through its hardware. Copyrighted content and private information in none networked system should be secured from outside access and the access from outside should be prevented and the car main AV system should be made to be secure against these accesses. IEC 62045-1 describes about that paths and security.

11 Regulation

Regulation regarding car is settled in each region and country. TC 100 standardisation does not enter to that regulation area.

However, the items outside of regulation can be a standardisation item of TC 100. TC 100 can standardize items outside of regulation.

For instance, a camera and monitor system as a mirror replacement is recognized as the same as the legacy mirror in some regulation because it is recognized as a safety device. This is a item outside of TC 100.

Annex A
(informative)

Network for smartphone

Smartphone can be a main device of the car main AV system including navigation system. Also, smartphone can be a part of the car main AV system.

In case of a smartphone is the main device, all control and communication is done by smartphone, audio and video reproduction and control can be done by devices of the car main AV system. In case of a smartphone is a part of the car main AV system, the control is done by the car main AV system, the communication between smartphone and the car main AV system is done with interface and application such as web server application.

Figure A.1 shows the main device case, Figure A.2 shows the part of the car main AV system case.

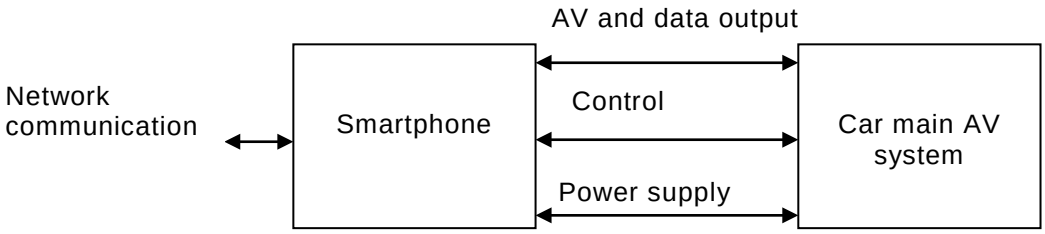


Figure A.1 – Main device case

The main device case, smartphone is a functional centre, all network communication is done by smartphone. Control, interface and output are connected to the external device which has more efficient display, loudspeaker, microphone and user interface than smartphne has.

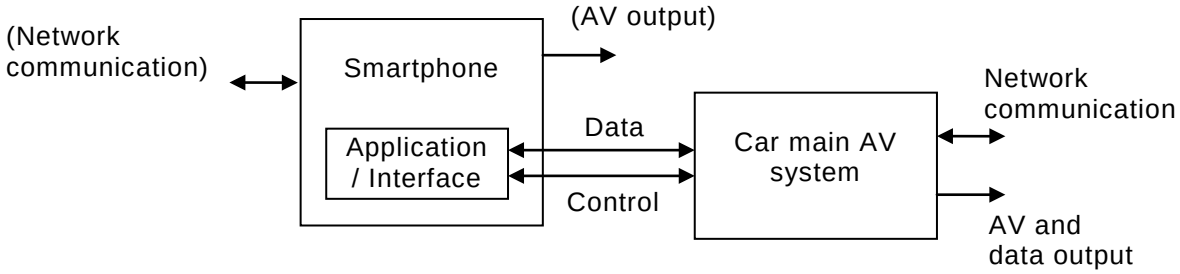


Figure A.2 – Part of the car main AV system case

The part of the car system case, smartphone is a part of the car main AV system, the car main AV system uses and control smartphone with interface or application. Network communication is done by the car main AV system, or smartphone can do whole of communication or part of communication. Audio, video and data reproduction and control is mainly done by the car main AV system.

Annex B
(informative)

IEC standard for security

Car multimedia systems and equipment should be secured for copyright, privacy and safety. Some IEC standards specify security issues as follows.

IEC 62045-1 ed1.0, *Multimedia security - Guideline for privacy protection of equipment and systems in and out of use - Part 1: General*

– This Technical Specification gives the guideline for methods for the protection of the user's privacy and access to content in consumer equipment and systems from outside except network access.

IEC 62227 ed1.0, *Multimedia home server systems - Digital rights permission code*

– This International Standard defines the permission code, a set of permission related information in short code form, the permission code is comprised of a common ID system to control and register the right of content.

IEC 62443 series, *Security for industrial process measurement and control - Network and system security*

– This series of International Standard, Technical Specification and Technical Report specifies secure method against cyber attack through network.

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