

## CONTENTS

1		
2		
3	<b>FOREWORD</b> .....	7
4	<b>INTRODUCTION</b> .....	9
5	<b>1 Scope</b> .....	10
6	<b>2 Normative references</b> .....	10
7	<b>3 Terms and definitions</b> .....	10
8	<b>4 Overview of the car system</b> .....	11
9	<b>5 Use case</b> .....	14
10	<b>5.1 General</b> .....	14
11	<b>5.2 Use experience system</b> .....	15
12	<b>5.2.1 General</b> .....	15
13	<b>5.2.2 Smart start</b> .....	15
14	<b>5.2.3 UX mirroring</b> .....	15
15	<b>5.2.4 Data synchronization</b> .....	15
16	<b>5.3 Infotainment system</b> .....	15
17	<b>5.3.1 General</b> .....	15
18	<b>5.3.2 Picture navigation</b> .....	15
19	<b>5.3.3 Car office system</b> .....	15
20	<b>5.3.4 Vehicle social network</b> .....	15
21	<b>5.3.5 Panoramic vision</b> .....	16
22	<b>5.3.6 OBD-based car maintenance service</b> .....	16
23	<b>5.4 Navigation system</b> .....	16
24	<b>5.4.1 General</b> .....	16
25	<b>5.4.2 Surrounding information</b> .....	16
26	<b>5.4.3 Geographical information</b> .....	16
27	<b>5.4.4 Drive information</b> .....	16
28	<b>5.4.5 Car information</b> .....	16
29	<b>5.4.6 Event information</b> .....	16
30	<b>5.5 Audio Visual entertainment system</b> .....	17
31	<b>5.5.1 General</b> .....	17
32	<b>5.5.2 3D audio system</b> .....	17
33	<b>5.5.3 Emotional service</b> .....	17
34	<b>5.6 Parking concierge system</b> .....	17
35	<b>5.7 Car monitoring system</b> .....	17
36	<b>5.8 Self-emergency call system</b> .....	17
37	<b>6 Networked system</b> .....	17
38	<b>6.1 General</b> .....	17
39	<b>6.2 Network inside of car</b> .....	17
40	<b>6.2.1 Car status information</b> .....	17
41	<b>6.2.2 Infotainment system network</b> .....	18
42	<b>6.2.3 Network of devices</b> .....	18
43	<b>6.3 Network outside of car</b> .....	19
44	<b>6.3.1 General</b> .....	19
45	<b>6.3.2 Network between car and car</b> .....	19
46	<b>6.3.3 Network between car and home</b> .....	19
47	<b>6.3.4 Network with cloud servers</b> .....	20

48	<u>7</u>	<u>Elements</u> .....	<u>20</u>
49	7.1	Device.....	20
50	7.1.1	Source.....	20
51	7.1.2	Sink.....	20
52	7.1.3	Sensor.....	20
53	7.1.4	Output device.....	21
54	7.1.5	Car black box device.....	21
55	7.1.6	Mobile device.....	21
56	7.2	Network and interface.....	21
57	7.2.1	Inside of car.....	21
58	7.2.2	Outside of car.....	21
59	7.3	Information.....	21
60	7.3.1	File format.....	21
61	7.3.2	Metadata.....	21
62	7.4	User interface device.....	22
63	7.4.1	General.....	22
64	7.4.2	Audio reproduction device.....	22
65	7.4.3	Video reproduction device.....	22
66	7.4.4	Input device.....	22
67	7.4.5	Output device.....	22
68	7.4.6	Wearable device.....	22
69	<u>8</u>	<u>Measurement method</u> .....	<u>23</u>
70	8.1	General.....	23
71	8.2	Audio video device.....	23
72	8.3	Sensor device.....	23
73	8.3.1	Camera.....	23
74	8.3.2	Other sensor.....	23
75	<u>9</u>	<u>Content</u> .....	<u>23</u>
76	9.1	General.....	23
77	9.2	Infotainment content.....	23
78	9.2.1	Map.....	23
79	9.2.2	Traffic and road information.....	23
80	9.2.3	Drive information.....	23
81	9.2.4	Network service information.....	24
82	9.2.5	Car maintenance information.....	24
83	9.3	AV content.....	24
84	<u>10</u>	<u>Security</u> .....	<u>24</u>
85	10.1	General.....	24
86	10.2	Networked systems and equipment.....	24
87	10.3	None networked system and equipment.....	24
88	<u>11</u>	<u>Regulation</u> .....	<u>25</u>
89		<u>Annex A (informative) Network for smartphone</u> .....	<u>26</u>
90		<u>Annex B (informative) IEC standard for security</u> .....	<u>27</u>
91		<u>Bibliography</u> .....	<u>28</u>
92		<u>FOREWORD</u> .....	<u>4</u>
93		<u>INTRODUCTION</u> .....	<u>6</u>
94		<u>1—Scope</u> .....	<u>7</u>

95	<u>2— Normative references.....</u>	<u>7</u>
96	<u>3— Terms and definitions .....</u>	<u>7</u>
97	<u>4— Overview of the car system .....</u>	<u>7</u>
98	<u>5— Use case .....</u>	<u>11</u>
99	<u>5.1— General.....</u>	<u>11</u>
100	<u>5.2— Smart start system .....</u>	<u>11</u>
101	<u>5.2.1— Smart start.....</u>	<u>11</u>
102	<u>5.2.2— UX mirroring.....</u>	<u>12</u>
103	<u>5.2.3— Data synchronization .....</u>	<u>12</u>
104	<u>5.3— Infotainment system .....</u>	<u>12</u>
105	<u>5.3.1— General.....</u>	<u>12</u>
106	<u>5.3.2— Picture navigation.....</u>	<u>12</u>
107	<u>5.3.3— Car office system .....</u>	<u>12</u>
108	<u>5.3.4— Vehicle social network.....</u>	<u>12</u>
109	<u>5.3.5— Panoramic vision.....</u>	<u>12</u>
110	<u>5.3.6— OBD-based car maintenance service .....</u>	<u>12</u>
111	<u>5.4— Navigation system.....</u>	<u>13</u>
112	<u>5.4.1— General.....</u>	<u>13</u>
113	<u>5.4.2— Surrounding information .....</u>	<u>13</u>
114	<u>5.4.3— Geographical information.....</u>	<u>13</u>
115	<u>5.4.4— Drive information.....</u>	<u>13</u>
116	<u>5.4.5— Car information .....</u>	<u>13</u>
117	<u>5.4.6— Event information .....</u>	<u>13</u>
118	<u>5.5— Audio Visual entertainment system .....</u>	<u>13</u>
119	<u>5.5.1— General.....</u>	<u>13</u>
120	<u>5.5.2— Emotional service .....</u>	<u>13</u>
121	<u>5.6— Parking concierge system.....</u>	<u>14</u>
122	<u>5.7— Car monitoring system.....</u>	<u>14</u>
123	<u>5.8— Self-emergency call system.....</u>	<u>14</u>
124	<u>6— Networked system.....</u>	<u>14</u>
125	<u>6.1— General.....</u>	<u>14</u>
126	<u>6.2— Network inside of car.....</u>	<u>14</u>
127	<u>6.2.1— Car status information .....</u>	<u>14</u>
128	<u>6.2.2— Infotainment system network .....</u>	<u>14</u>
129	<u>6.2.3— Network of devices .....</u>	<u>15</u>
130	<u>6.3— Network outside of car.....</u>	<u>15</u>
131	<u>6.3.1— General.....</u>	<u>15</u>
132	<u>6.3.2— Network between car and car .....</u>	<u>15</u>
133	<u>6.3.3— Network between car and home.....</u>	<u>16</u>
134	<u>6.3.4— Network with cloud servers .....</u>	<u>16</u>
135	<u>7— Elements.....</u>	<u>17</u>
136	<u>7.1— Device .....</u>	<u>17</u>
137	<u>7.1.1— Source.....</u>	<u>17</u>
138	<u>7.1.2— Sink .....</u>	<u>17</u>
139	<u>7.1.3— Sensor.....</u>	<u>17</u>
140	<u>7.1.4— Output device.....</u>	<u>17</u>
141	<u>7.1.5— Car black box device.....</u>	<u>17</u>
142	<u>7.1.6— Mobile device.....</u>	<u>17</u>

143	<u>7.2</u>	<u>Network and interface</u>	<u>18</u>
144	<u>7.2.1</u>	<u>Inside of car</u>	<u>18</u>
145	<u>7.2.2</u>	<u>Outside of car</u>	<u>18</u>
146	<u>7.3</u>	<u>Information</u>	<u>18</u>
147	<u>7.3.1</u>	<u>File format</u>	<u>18</u>
148	<u>7.3.2</u>	<u>Metadata</u>	<u>18</u>
149	<u>7.4</u>	<u>User interface device</u>	<u>18</u>
150	<u>7.4.1</u>	<u>General</u>	<u>18</u>
151	<u>7.4.2</u>	<u>Audio reproduction device</u>	<u>18</u>
152	<u>7.4.3</u>	<u>Video reproduction device</u>	<u>18</u>
153	<u>7.4.4</u>	<u>Input device</u>	<u>19</u>
154	<u>7.4.5</u>	<u>Output device</u>	<u>19</u>
155	<u>7.4.6</u>	<u>Wearable device</u>	<u>19</u>
156	<u>8</u>	<u>Measurement method</u>	<u>19</u>
157	<u>8.1</u>	<u>General</u>	<u>19</u>
158	<u>8.2</u>	<u>Audio video device</u>	<u>19</u>
159	<u>8.3</u>	<u>Sensor device</u>	<u>19</u>
160	<u>8.3.1</u>	<u>Camera</u>	<u>19</u>
161	<u>8.3.2</u>	<u>Other sensor</u>	<u>19</u>
162	<u>9</u>	<u>Content</u>	<u>20</u>
163	<u>9.1</u>	<u>General</u>	<u>20</u>
164	<u>9.2</u>	<u>Infotainment content</u>	<u>20</u>
165	<u>9.2.1</u>	<u>Map</u>	<u>20</u>
166	<u>9.2.2</u>	<u>Traffic and road information</u>	<u>20</u>
167	<u>9.2.3</u>	<u>Drive information</u>	<u>20</u>
168	<u>9.2.4</u>	<u>Network service information</u>	<u>20</u>
169	<u>9.2.5</u>	<u>Car maintenance information</u>	<u>20</u>
170	<u>9.3</u>	<u>AV content</u>	<u>20</u>
171	<u>10</u>	<u>Security</u>	<u>20</u>
172	<u>10.1</u>	<u>General</u>	<u>20</u>
173	<u>10.2</u>	<u>Networked systems and equipment</u>	<u>21</u>
174	<u>10.3</u>	<u>None networked system and equipment</u>	<u>21</u>
175	<u>11</u>	<u>Regulation</u>	<u>21</u>
176	<u>Annex A (informative)</u>	<u>Network for smartphone</u>	<u>22</u>
177	<u>Annex B (informative)</u>	<u>IEC standard for security</u>	<u>23</u>
178	<u>Bibliography</u>		<u>24</u>
179	<u>FOREWORD</u>		<u>4</u>
180	<u>INTRODUCTION</u>		<u>6</u>
181	<u>1</u>	<u>Scope</u>	<u>7</u>
182	<u>2</u>	<u>Normative references</u>	<u>7</u>
183	<u>3</u>	<u>Terms and definitions</u>	<u>7</u>
184	<u>4</u>	<u>Overview of the car system</u>	<u>8</u>
185	<u>5</u>	<u>Use case</u>	<u>11</u>
186	<u>5.1</u>	<u>General</u>	<u>11</u>
187	<u>5.2</u>	<u>Infotainment system</u>	<u>11</u>
188	<u>5.3</u>	<u>Navigation system</u>	<u>12</u>
189	<u>5.3.1</u>	<u>General</u>	<u>12</u>

190	5.3.2	Surrounding information	12
191	5.3.3	Geographical information	12
192	5.3.4	Drive information	12
193	5.3.5	Car information	12
194	5.3.6	Event information	12
195	5.4	Audio Visual entertainment system	12
196	5.4.1	General	12
197	6	Networked system	13
198	6.1	General	13
199	6.2	Network inside of car	13
200	6.2.1	Car status information	13
201	6.2.2	Infotainment system network	13
202	6.2.3	Network of devices	14
203	6.3	Network outside of car	14
204	6.3.1	General	14
205	6.3.2	Network between car and car	14
206	6.3.3	Network between car and home	14
207	6.3.4	Network with cloud servers	15
208	7	Elements	15
209	7.1	Device	15
210	7.1.1	Source	15
211	7.1.2	Sink	15
212	7.1.3	Sensor	16
213	7.1.4	Output device	16
214	7.1.5	Mobile device	16
215	7.2	Network and interface	16
216	7.2.1	Inside of car	16
217	7.2.2	Outside of car	16
218	7.3	Information	16
219	7.3.1	File format	16
220	7.3.2	Metadata	17
221	7.4	User interface device	17
222	7.4.1	General	17
223	7.4.2	Audio reproduction device	17
224	7.4.3	Video reproduction device	17
225	7.4.4	Input device	17
226	7.4.5	Output device	17
227	7.4.6	Wearable device	17
228	8	Measurement method	18
229	8.1	General	18
230	8.2	Audio video device	18
231	8.3	Sensor device	18
232	8.3.1	Camera	18
233	8.3.2	Other sensor	18
234	9	Content	18
235	9.1	General	18
236	9.2	Infotainment content	18
237	9.2.1	Map	18

238	<del>9.2.2</del>	<del>Traffic and road information</del>	<del>18</del>
239	<del>9.2.3</del>	<del>Drive information</del>	<del>18</del>
240	<del>9.2.4</del>	<del>Network service information</del>	<del>18</del>
241	<del>9.3</del>	<del>AV content</del>	<del>18</del>
242	<del>10</del>	<del>Security</del>	<del>19</del>
243	<del>10.1</del>	<del>General</del>	<del>19</del>
244	<del>10.2</del>	<del>Networked systems and equipment</del>	<del>19</del>
245	<del>10.3</del>	<del>None networked system and equipment</del>	<del>19</del>
246	<del>11</del>	<del>Regulation</del>	<del>19</del>
247	<del>Annex A (informative)</del>	<del>Network for smartphone</del>	<del>20</del>
248	<del>Annex B (informative)</del>	<del>IEC standard for security</del>	<del>21</del>
249	<del>Bibliography</del>		<del>22</del>
250			
251	Figure 1	TC100 system model by data communication	11
252	Figure 2	User communication model	12
253	Figure 3	Communication between TC100 models	12
254	Figure 4	Car model	13
255	Figure 5	Networked systems	13
256	Figure 6	Modes	14
257	Figure 7	Car status information	18
258	Figure 8	Infotainment system network	18
259	Figure 9	AV devices	19
260	Figure 10	Network between car and car	19
261	Figure 11	Network between car and home	20
262	Figure 12	Network with cloud	20
263	Figure A.1	Main device case	26
264	Figure A.2	Part of the car main system case	26
265			
266			
267			

## 268 INTERNATIONAL ELECTROTECHNICAL COMMISSION

269

270

271

272

273

274

**THE CONCEPTUAL MODEL OF STANDARDIZATION  
FOR MULTIMEDIA CAR SYSTEMS AND EQUIPMENT****FOREWORD**

275 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising  
276 all national electrotechnical committees (IEC National Committees). The object of IEC is to promote  
277 international co-operation on all questions concerning standardization in the electrical and electronic fields. To  
278 this end and in addition to other activities, IEC publishes International Standards, Technical Specifications,  
279 Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC  
280 Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested  
281 in the subject dealt with may participate in this preparatory work. International, governmental and non-  
282 governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely  
283 with the International Organization for Standardization (ISO) in accordance with conditions determined by  
284 agreement between the two organizations.

285 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international  
286 consensus of opinion on the relevant subjects since each technical committee has representation from all  
287 interested IEC National Committees.

288 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National  
289 Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC  
290 Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any  
291 misinterpretation by any end user.

292 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications  
293 transparently to the maximum extent possible in their national and regional publications. Any divergence  
294 between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in  
295 the latter.

296 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity  
297 assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any  
298 services carried out by independent certification bodies.

299 6) All users should ensure that they have the latest edition of this publication.

300 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and  
301 members of its technical committees and IEC National Committees for any personal injury, property damage or  
302 other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and  
303 expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC  
304 Publications.

305 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is  
306 indispensable for the correct application of this publication.

307 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of  
308 patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

309 The main task of IEC technical committees is to prepare International Standards. However, a  
310 technical committee may propose the publication of a technical report when it has collected  
311 data of a different kind from that which is normally published as an International Standard, for  
312 example "state of the art".

313 IEC TR 6XXXX, which is a technical report, has been prepared by IEC technical committee  
314 100: Audio, video and multimedia systems and equipment.

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

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

316

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

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

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

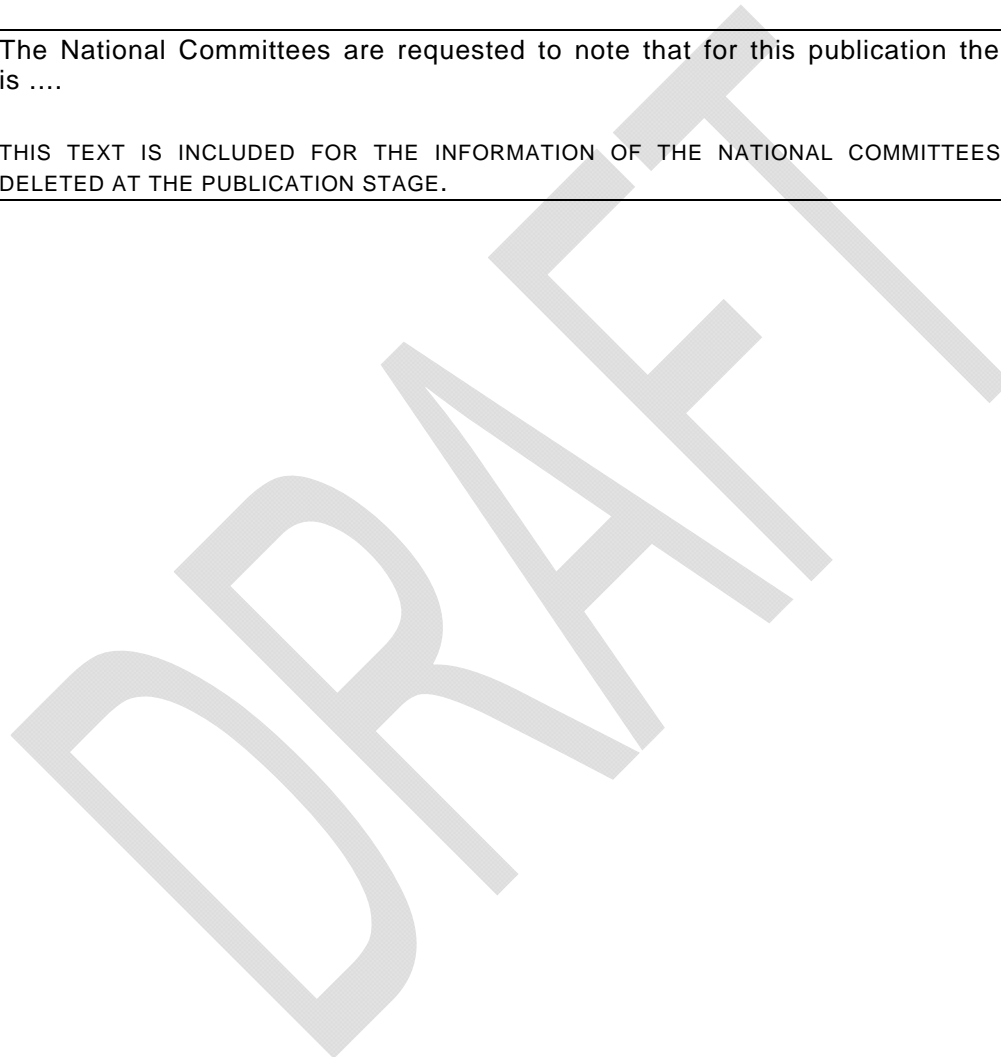
- 323 • reconfirmed,
- 324 • withdrawn,
- 325 • replaced by a revised edition, or
- 326 • amended.

327

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

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

332





333

## INTRODUCTION

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

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

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

345

346

DRAFT

# THE CONCEPTUAL MODEL OF STANDARDIZATION FOR MULTIMEDIA CAR SYSTEMS AND EQUIPMENT

347  
348  
349  
350

## 351 1 Scope

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

## 354 2 Normative references

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

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

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

## 363 3 Terms and definitions

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

### 365 3.1

#### 366 **car main system**

367 main AV and multimedia system installed in car

### 368 3.2

#### 369 **working and functional mode**

370 mode of various car's working and function

### 371 3.3

#### 372 **function and specification mode**

373 mode of TC 100 system depending on working and functional mode

### 374 3.4 UX mirroring

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

### 379 3.5 Picture navigation

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

383

384

385

386

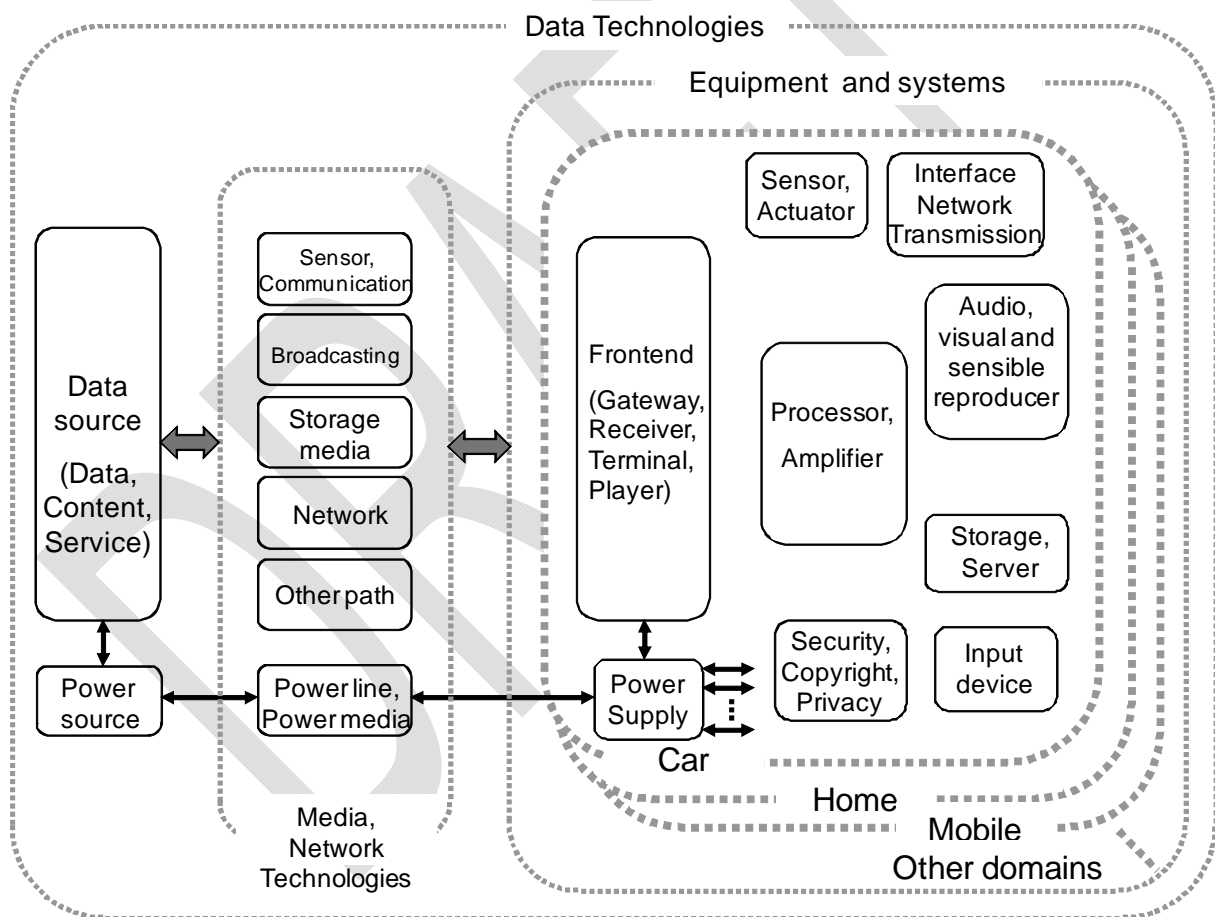
387

388

389

390 **4 Overview of the car system**

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

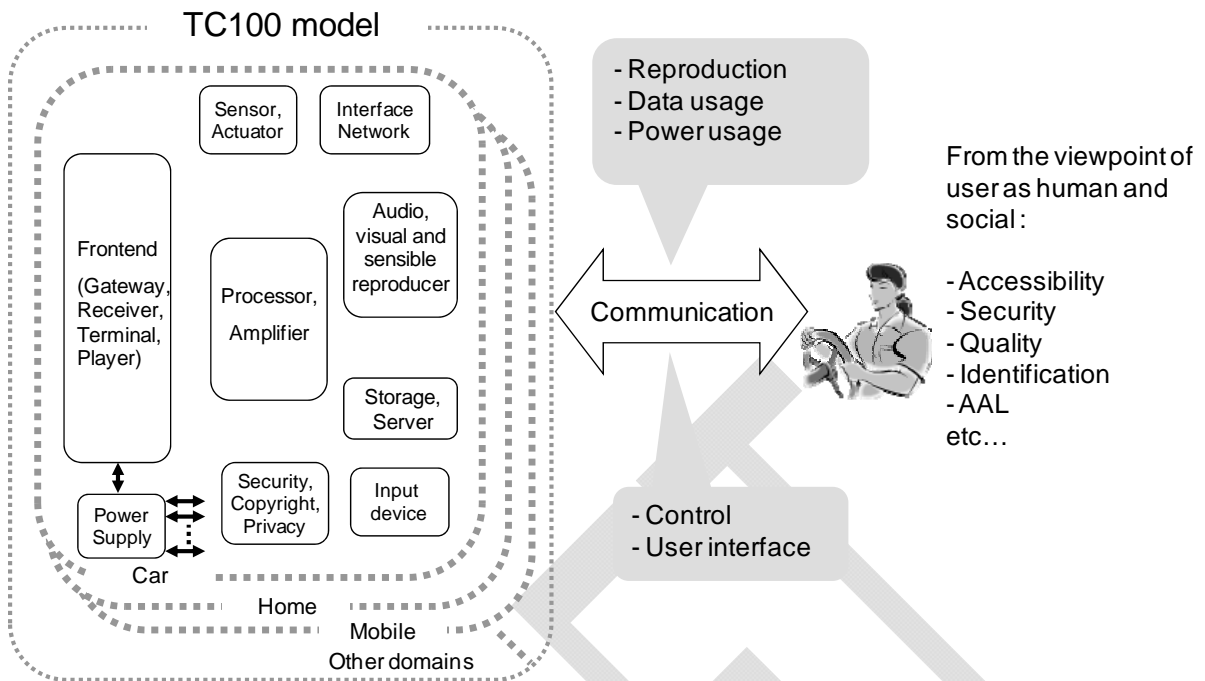


395

396 **Figure 1 – TC100 system model by data communication**

397 The communication model between the system and user is described in Figure 2. This is TC  
 398 100 model and it is applied to car. The user is driver, passenger, pedestrian in car domain  
 399 and users in other domains.

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



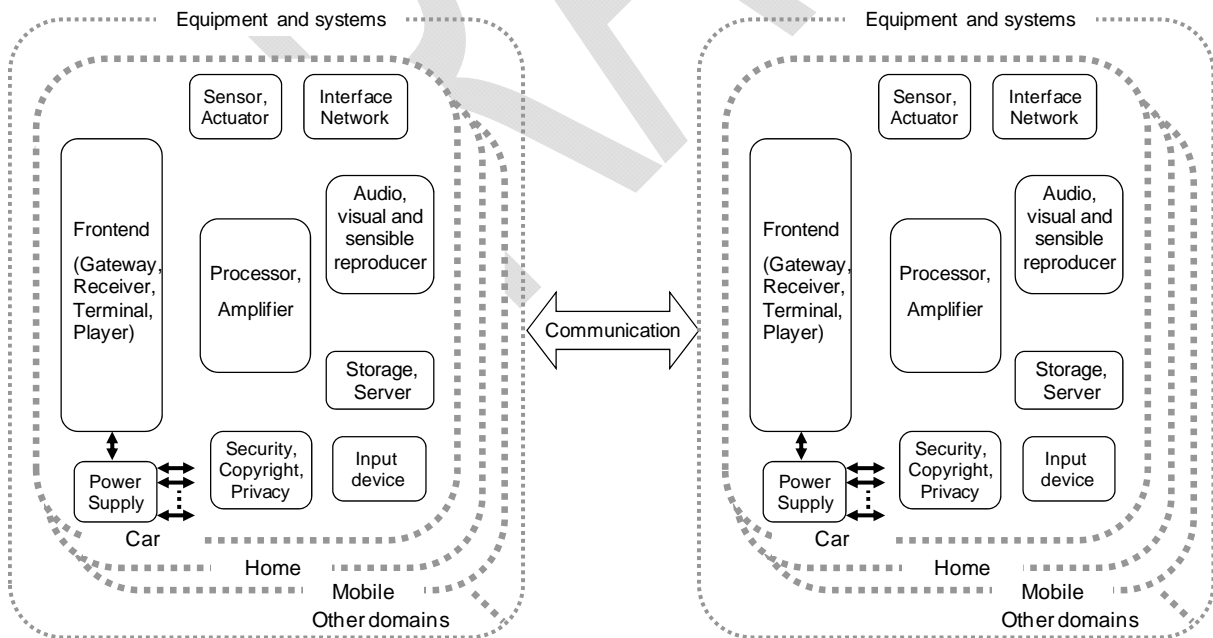
403

404

405

406

**Figure 2 – User communication model**



407

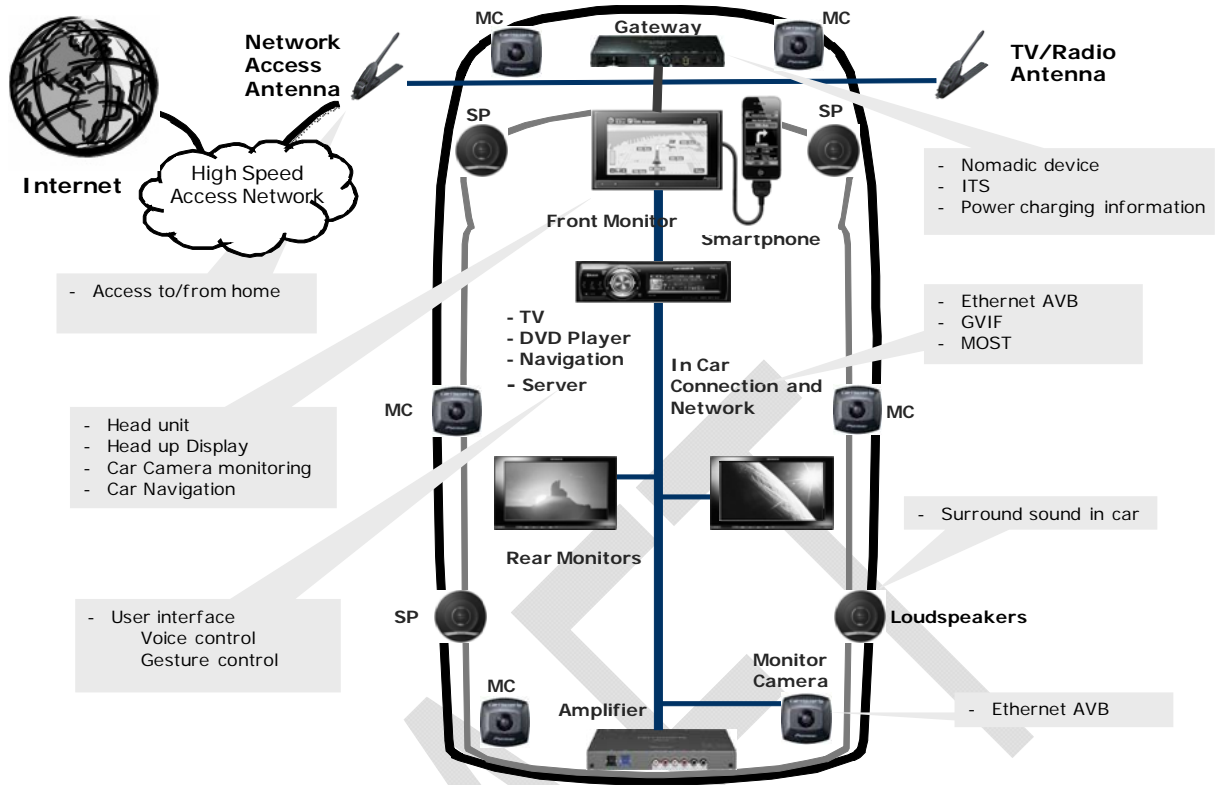
408

**Figure 3 – Communication between TC100 models**

409

410 For the car system model, more concrete model is described in Figure 4.

411

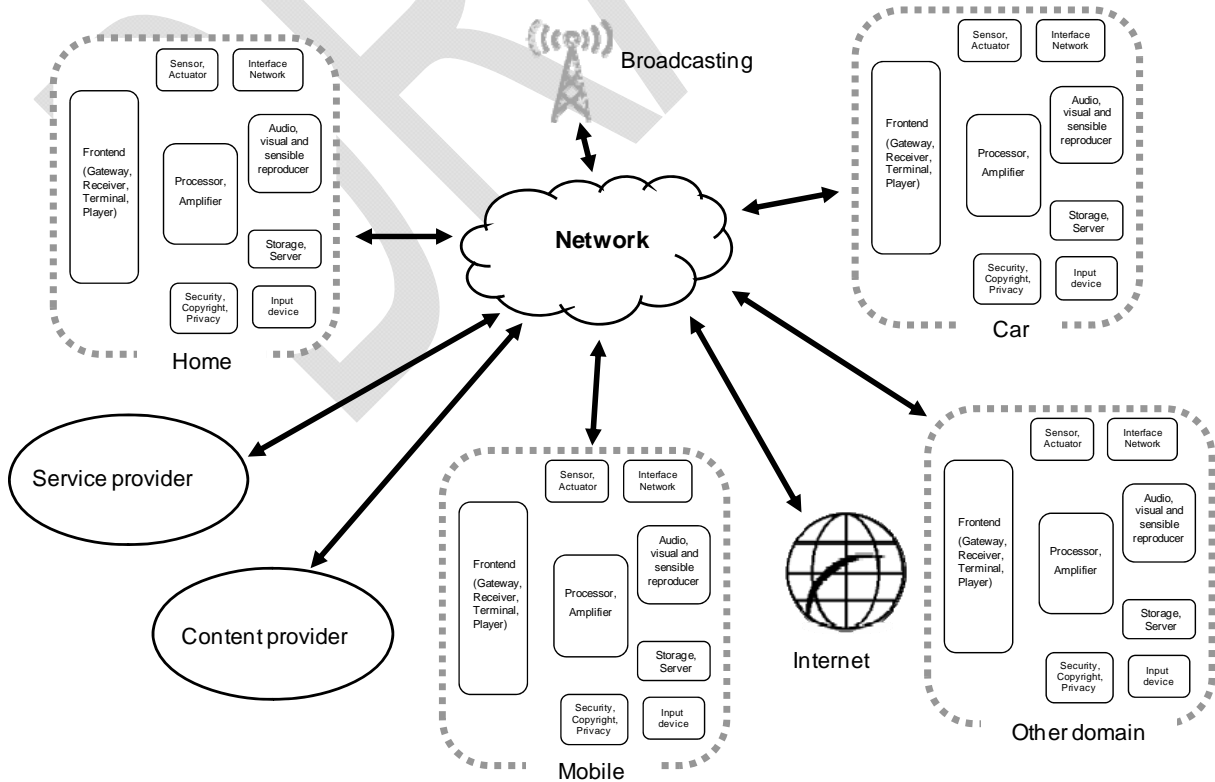


412

413

Figure 4 – Car model

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



416

417

Figure 5 – Networked systems

418

419 **5 Use case**

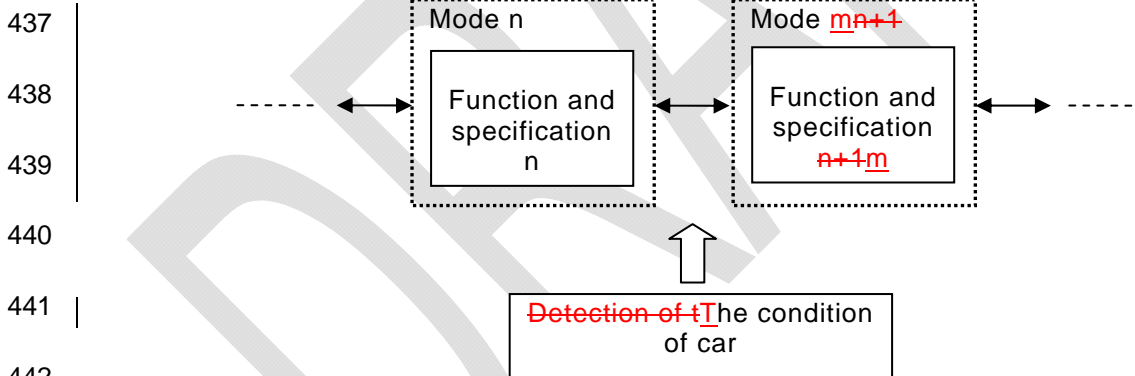
420 **5.1 General**

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

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

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

436



443 **Figure 6 – Modes**

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

- 445 – when car is stopping, all function of e-mail is available for driver,
- 446 – when car is driving, some restricted function is available for driver's safety, as text-to-  
447 speech to read e-mail, speech-to-text to send e-mail, or only e-mail notification on display  
448 device,
- 449 – when car is at rest, e-mail is stored and forwarded to other if necessary,
- 450 – when some urgent event is happened, alert e-mail is sent automatically.

451 Any other infotainment and services have the similar mode dependent function and  
452 specifications.

## 453 5.2 Use experience Smart start system

### 454 5.2.1 General

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

### 457 5.2.2 Smart start

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

### 462 5.2.3 UX mirroring

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

### 467 5.2.4 Data synchronization

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

## 470 5.3 Infotainment system

### 471 5-25.3.1 General

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

474 The function and specification of infotainment system has various mode depending on car  
475 working and functional mode and users. The mode will shift as it is required and needed by  
476 user or other.

### 477 5.3.2 Picture navigation

478 Navigation system of the a smart device or the a smart car can find a location with geotagged  
479 pictures which include contain latitude and longitude coordinates.

### 480 5.3.3 Car office system

#### 481 5.3.3.1 Under-light office

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

### 484 5.3.4 Vehicle social network

485 Communication among cars can give users the opportunity to exchange traffic information  
486 such as vehicle speed, traffic accidents and congestion ahead. A smart car can gather (or  
487 get) such information by experience (or by other smart cars running on the opposite lane).  
488 This information can be visualized on a display device, or verbalized, or given in other  
489 optimized ways for users.

490 **5.3.5 Panoramic vision**

491 360-degree panoramic view around a smart car can be reconstructed from video images from  
492 cameras installed around a smart car, which helps users see blind spots easily and drive  
493 more safely.

494 **5.3.6 OBD-based car maintenance service**

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

497 **5.3.5.4 Navigation system**

498 **5.3.15.4.1 General**

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

503 **5.3.25.4.2 Surrounding information**

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

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

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

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

512 **5.3.35.4.3 Geographical information**

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

515 **5.3.45.4.4 Drive information**

516 This information is history and plan or foresee of car diving on the geographical map. User  
517 drive the car with this information or navigation system assists drive and driver. This has the  
518 same various function and specification modes.

519 **5.3.55.4.5 Car information**

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

524 This information can be monitored over network by other user.

525 **5.3.65.4.6 Event information**

526 Event is various status change of car and effect on car from outside and inside such as  
527 change of acceleration, raining, turning on/off light. These are recognized by sensor or car  
528 control system, this information can be used to trigger shifting car working and functional  
529 mode.



530 **5.45.5 Audio Visual entertainment system**

531 **5.4.15.5.1 General**

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

533 **5.5.2 3D audio system**

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

536 **5.5.3 Emotional service**

537 **5.5.3.1 Emotion-based music streaming**

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

541 **5.6 Parking concierge system**

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

547 **5.7 Car monitoring system**

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

551 **5.8 Self-emergency call system**

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

555

556

557

558 **6 Networked system**

559 **6.1 General**

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

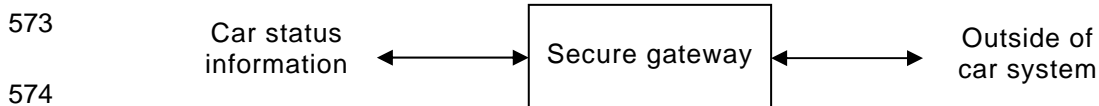
563 **6.2 Network inside of car**

564 **6.2.1 Car status information**

565 The electric and electronic system of car has its own information, which is mainly information  
566 regarding car control and driving. These car information are important information for safety  
567 and security of the car, they must be secured from outside access of the car. Car information

568 is environment status information such as air condition and temperature, door status, glass  
 569 status, and driving status information such as speed, tire status. These car status information  
 570 may be accessible from outside if security and safety is guaranteed by such as secure  
 571 gateway.

572



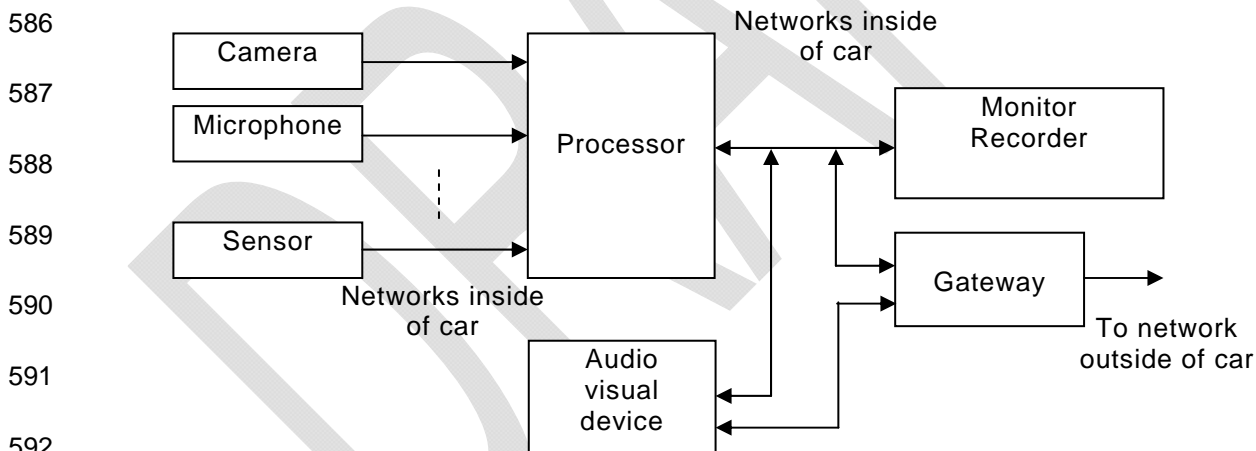
574

575 **Figure 7 – Car status information**

576 **6.2.2 Infotainment system network**

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

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



590

591

592

593 **Figure 8 – Infotainment system network**

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

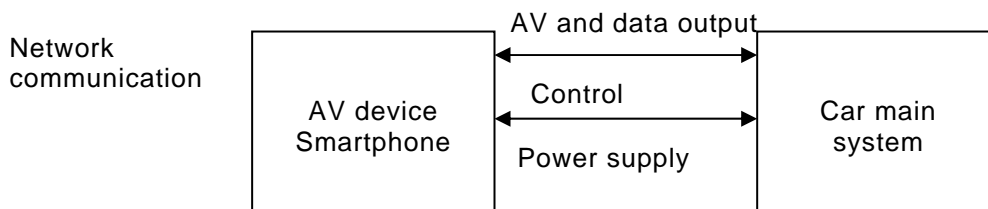
596 **6.2.3 Network of devices**

597 **6.2.3.1 AV devices and smartphone**

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

603

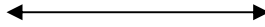
604



605



606



607

**Figure 9 – AV devices**

### 6.3 Network outside of car

#### 6.3.1 General

The network may be IP based network, 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.

616

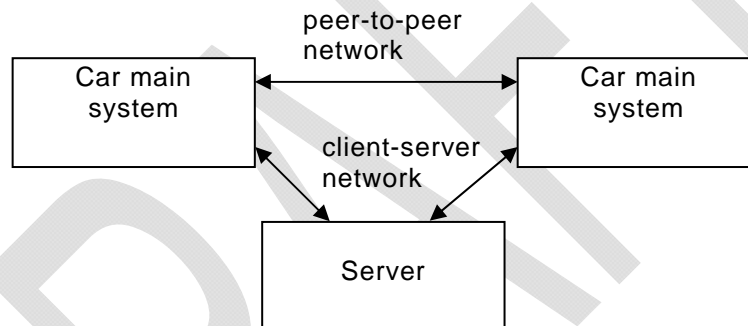
617

618

619

620

621



622

**Figure 10 – Network between car and car**

623

#### 6.3.3 Network between car and home

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

627

628

629

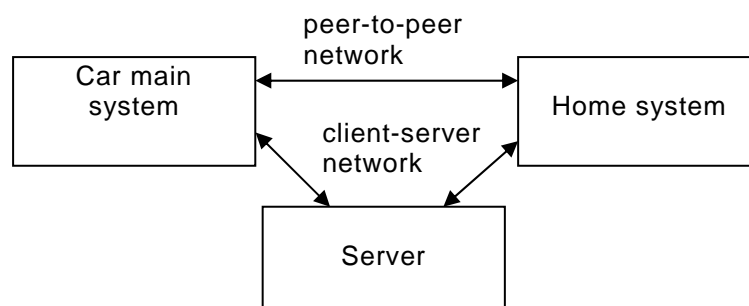
630

631

632

633

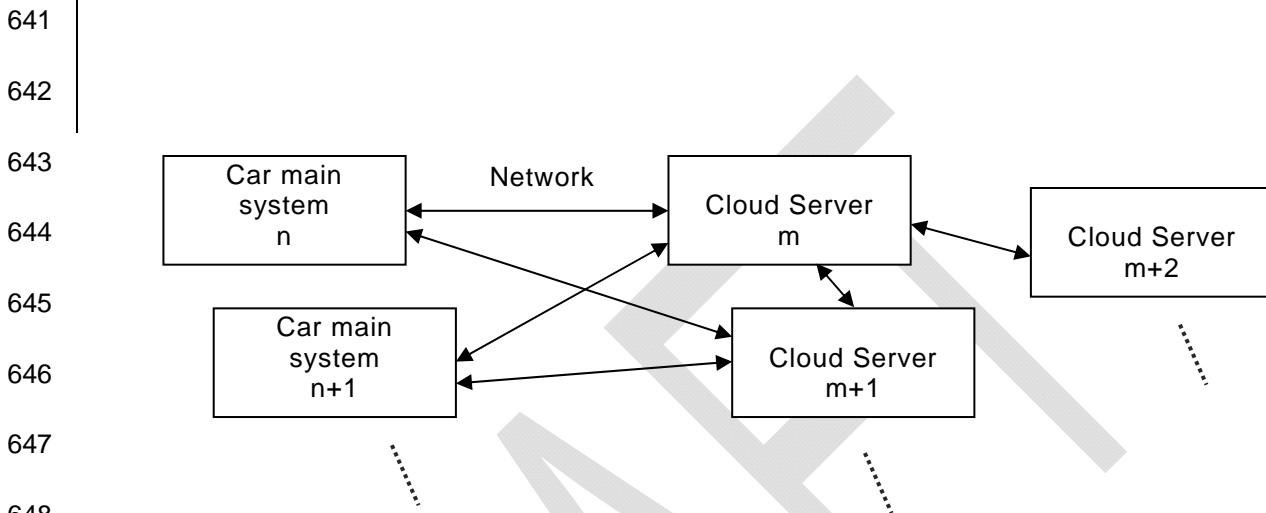
634



635 **Figure 11 – Network between car and home**

636 **6.3.4 Network with cloud servers**

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



649 **Figure 12 – Network with cloud**

650 **7 Elements**

651 **7.1 Device**

652 **7.1.1 Source**

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

657 Moving requires tolerance to vibration and acceleration, large range of circumstance  
658 parameters requires temperature range, humidity range and light range, and wireless  
659 communication means that communication is not stable.

660 **7.1.2 Sink**

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

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

664 **7.1.3 Sensor**

665 **7.1.3.1 Camera and microphone**

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

### 668 7.1.3.2 Geographical sensor

669 Sensors can be used by car which is moving to obtain geographic information of  
670 circumstances, car itself and other cars and objects. They are radar, GPS, WiFi information,  
671 geomagnetic sensor, navigation information and signage information.

### 672 7.1.3.3 Circumstance sensor

673 Sensors capture information of moving car, they are temperature, air pressure, light,  
674 acceleration,

### 675 7.1.4 Output device

676 Audio visual reproduction devices and other reproduction device for human sense.

### 677 [7.1.5](#) Car black box device

678 Car black box devices are necessary to record video around the car.

### 679 ~~7.1.5~~ 7.1.6 Mobile device

680 Mobile, carryable and wearable device can be loaded in car.

681 Wearable device is very close to driver or passenger, it can be a human interfaec for  
682 multimedia car systems and equipment.

## 683 7.2 Network and interface

### 684 7.2.1 Inside of car

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

687 The interface between car control system and multimedia car systems and equipment should  
688 have a gateway to ensure from interfere car control system. This means that necessary  
689 information of car control system can be transmitted to multimedia car systems and  
690 equipment but multimedia car systems and equipment cannot access to car control system.

### 691 7.2.2 Outside of car

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

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

## 697 7.3 Information

### 698 7.3.1 File format

699 For multimedia car systems and equipment, all file formats that are used for home system can  
700 be applicable.

### 701 7.3.2 Metadata

702 For multimedia car systems and equipment, all file formats that are used for home system can  
703 be applicable. In addition car system specific metadata is specified. It is caused because of  
704 car nature that is movable and autonomous. Autonomous system senses the outside world  
705 and moves, metadata regarding that nature is specified.

706 **7.4 User interface device**

707 **7.4.1 General**

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

709 **7.4.2 Audio reproduction device**

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

712 **7.4.3 Video reproduction device**

713 **7.4.3.1 Monitor**

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

715 **7.4.3.2 HUD**

716 Head up display is used especially for car, there are attached to car glass type and installed  
717 in car glass type.

718 **7.4.3.3 Display installed in car body**

719 Monitor can be a part of the car body, front glass can be a display and the car body inside  
720 and outside can be a display.

721 **7.4.4 Input device**

722 **7.4.4.1 Voice or human recognition**

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

725 **7.4.4.2 3D gesture**

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

728 **7.4.5 Output device**

729 **7.4.5.1 Audio device**

730 Audio device is used as audible interface to user.

731 **7.4.5.2 Video device**

732 Not monitor but used as visual interface to user.

733 **7.4.5.3 Sensible device**

734 Any sensible device can be used as interface to user.

735 **7.4.6 Wearable device**

736 Wearable devices are very close device to user, these can be used as user interface between  
737 car main system and user.

## 738 8 Measurement method

### 739 8.1 General

740 The method for car should consider circumstances of car for each measurement.

### 741 8.2 Audio video device

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

### 745 8.3 Sensor device

746 Any kind of source device should apply circumstances as audio video device.

#### 747 8.3.1 Camera

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

#### 749 8.3.2 Other sensor

750 Other sensor devices need to be measured under the wide range of light and luminance  
751 conditions.

## 752 9 Content

### 753 9.1 General

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

### 756 9.2 Infotainment content

#### 757 9.2.1 Map

758 Map content is specific for car system. Map content for car needs further information than the  
759 usual maps, they are information for car navigation and information of any kind of regional  
760 information including business issues such as signage. Also map is integrated with other  
761 infotainment information described in followings.

##### 762 9.2.1.1 Map format

763 The format for map content for car should be made as high-functioning map. There are many  
764 kind of information regarding car map, electric map formats are defined by ISO and other  
765 SDOs but the map for infotainment of car need to be clarified.

#### 766 9.2.2 Traffic and road information

767 This information is provided by other system than TC 100 system, for instance ITS and  
768 telematics are cases. However any services of Internet can be used for TC 100 system  
769 including such kind of information.

#### 770 9.2.3 Drive information

771 Drive information is created by the car activities, such as view and sound information around  
772 car and event information. It is also created by other car.

773 **9.2.4 Network service information**

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

776 **9.2.5 Car maintenance information**

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

779 **9.3 AV content**

780 This is the same as home system.

781 **10 Security**

782 **10.1 General**

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

789 Another aspect of security regarding car is that car and drive system have a responsibility for  
790 user's safety, multimedia car system and equipment should not affect that safety. Multimedia  
791 car system and equipment may have a path to car and its drive system, data communication  
792 through that path should not affect car and drive system and should be secured. Also  
793 multimedia car system and equipment can affect driver of car, that should not affect driver's  
794 car operation.

795 **10.2 Networked systems and equipment**

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

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

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

807 **10.3 None networked system and equipment**

808 None networked system and equipment has no path from outside trough network, it has a  
809 path from outside through its hardware paths. IEC 62045-1 describes about that paths.

810 Copyrighted content and private information in none networked system and equipment should  
811 be secured from outside access.

812 None networked multimedia car system and equipment has a path from outside access, the  
813 access from outside should be prevented and the system should be made to be secure  
814 against these accesses.



**815 11 Regulation**

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

818 However, outside of regulation can be a standardised item. For instance, camera and  
819 monitor system as a mirror replacement ~~camera and monitor system~~ is recognized as the  
820 same as the legacy mirror in some regulation because it is recognized as a safety device. TC  
821 100 can standardize items outside of safety.

DRAFT

822  
823  
824  
825

**Annex A**  
(informative)

**Network for smartphone**

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

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

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

835

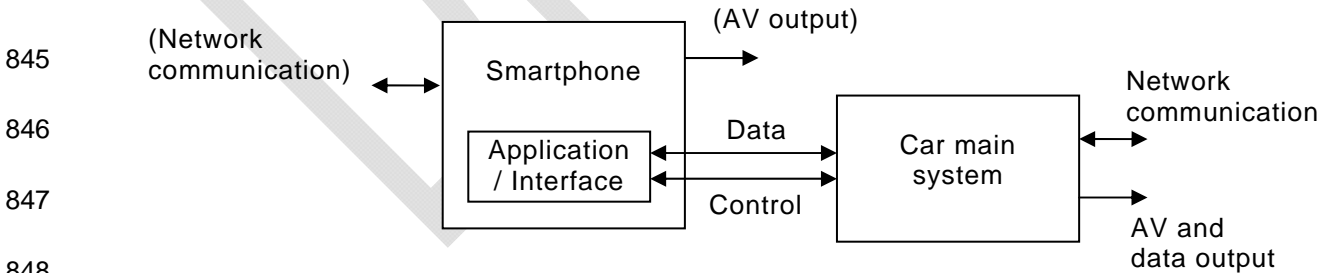


839

840 **Figure A.1 – Main device case**

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

844



848

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

850 In the part of the car system case, smartphone is a part of the car main system, the car main  
851 system uses and control smartphone with interface or application. Network communication is  
852 done by the car main device, or smartphone can do whole of communication or part of  
853 communication. Audio, video and data reproduction and control is done by the car main  
854 system.

855

856

857  
858  
859  
860

## **Annex B** (informative)

### **IEC standard for security**

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

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

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

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

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

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

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

876

## Bibliography

877

878

879

880

DRAFT