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Omrežje gospodinjskih aparatov in povezljivost mreže - 1. del: Splošne zahteve, modeliranje rodovnih podatkov in nevtralna sporočila

Household appliances network and grid connectivity - Part 1: General Requirements, Generic Data Modelling and Neutral Messages

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ICS:

97.030	Električni aparati za dom na splošno	Domestic electrical appliances in general
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Household appliances network and grid connectivity - Part 1: General Requirements, Generic Data Modelling and Neutral Messages

To be completed

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This draft European Standard is submitted to CENELEC members for enquiry.
Deadline for CENELEC: 2016-05-20.

It has been drawn up by CLC/TC 59X.

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157 **European foreword**

158 This document was prepared by the WG 7 (Smart Household Appliances) of Technical Committee CENELEC
 159 TC 59X (Performance of household and similar electrical appliances).

160 This document is currently submitted to the Enquiry.

161 This document has been prepared under a mandate given to CENELEC by the European Commission and
 162 the European Free Trade Association.

- latest date by which the existence of this document has to be announced at national level (doa) dor + 6 months
- latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) dor + 12 months
- latest date by which the national standards conflicting with this document have to be withdrawn (dow) dor + 36 months (to be confirmed or modified when voting)

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164 Introduction

165 Energy management systems will more and more become necessary due to change from fossil and nuclear to
 166 renewable production and the associated decentralisation. Since an appropriate standard for a home &
 167 building management is in preparation this European Standard specifies how sets of products from multiple
 168 manufacturers are able to interoperate with Home & Building / Customer Energy Management Systems,
 169 located in a home network or in the cloud, in the most interoperable manner.

170 This standard focuses on interworking of household appliances and describes the necessary control and
 171 monitoring. It defines a set of functions of household and similar electrical appliances. The functions in this
 172 standard cover next to energy-management main remote-control and – monitoring use cases.

173 This European Standard does not deal with safety requirements. Safety requirements have been set in
 174 IEC/EN 60335-x [17]. These requirements shall be applied to smart appliances using remote functionality.

175 prEN-50631 will provide interoperability on information exchange among various appliances in the home. The
 176 standard will be split into 4 parts:

177 **prEN-50631-1:** *Household appliances network and grid connectivity - General Requirements, Generic Data*
 178 *Modeling and Neutral Messages*

179 **prEN-50631-2-x:** *Household appliances network and grid connectivity - Product Specific Requirements and -*
 180 *Specifications*

181 **prEN-50631-3:** *Household appliances network and grid connectivity – General Test-Requirements & -*
 182 *Specifications*

183 **prEN-50631-4-x:** *Household appliances network and grid connectivity – Technology Specific Implementation*
 184 *and Test Requirements*

185 Data communication heavily depends on the environment of appliances. Sometimes low bitrate or energy
 186 efficient communication puts strict requirements to selected communication technologies. Therefore, popular
 187 and de facto standards had been and will be developed by the industry to fulfil such requirements. To not
 188 influence common data modeling for appliances because of such restrictions, the standardized data models
 189 and neutral message structures must be applied to communication technologies.

190 This standard series therefore is intended to separate data modeling and neutral message structure from the
 191 attached communication.

192 Part 1 describes general requirements, generic data modeling and generic neutral messages without relation
 193 to any specific communication technology or any product specific layout.

194 Part 2 lists and specifies product specific requirements and implementation guidance based on the generic
 195 data model and generic neutral messages

196 Part 3 describes Test-Requirements and Test-Specifications

197 Part 4 describes the mapping of neutral messages to examples of typical communication protocols like
 198 ZigBee, SEP2.0, KNX, Allseen, OIC, SHIP, Echonet light. These communication protocols are neither
 199 mandatory nor to be seen as complete spectrum of communication protocols. A few can be found at [6] - [13].

201 1 Scope

202 This document defines data models for Interoperable Connected Household Appliances. The data model is
203 derived from a logical decomposition of use cases into functional blocks that themselves are realized by
204 abstract actions on the data model itself.

205 2 Normative references

206 The following referenced documents are indispensable for the application of this document. For dated
207 references, only the edition cited applies. For undated references, the latest edition of the referenced
208 document (including any amendments) applies.

209 IEC TR 62746-2:2015, *Systems interface between customer energy management system and the power*
210 *management system - Part 2: Use cases and requirements*

211 EN 50523 (all parts), *Household appliances interworking*

212 EN 60335 (all parts), *Household and similar electrical appliances – Safety –*

213 RFC 2119, *Key words for use in RFCs to Indicate Requirement Levels*, March 1997

214 3 Terms, definitions and abbreviations

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

216 3.1 Terms and definitions

217 3.1.1

218 **appliance**

219 electrical apparatus intended for household or similar use.

220 Note 1 to entry: An Appliance can only act as a load.

221 Examples: Refrigerators, dishwashers, clothes washers, clothes dryers, air conditioners, water heaters,
222 circulation pumps etc.

223 3.1.2

224 **product**

225 manufactured item that is usually packaged and offered for sale as a single unit.

226 3.1.3

227 **activation**

228 completion of connections, communications pathways and/or settings necessary to enable smart operation.

229 3.1.4

230 **Normal User operation**

231 operation of a Device under direct user control.

232 Note 1 to entry: Includes operation under the influence of remote controls provided with the appliance or
233 device.

234 Note 2 to entry: A Smart Device may default to Normal User Operation if the DCM is inactive, deactivated or
235 removed.

236 3.1.5

237 **manual over-ride**

238 return to Normal User Operation that terminates or prevents a period of Smart Operation, that is initiated by
239 the User.

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240

241 **3.1.6**
 242 **Smart Appliance**
 243 appliance that:

- 244 1) incorporates or has been equipped with a DCM; and
 245 2) is capable of Smart Operation.

246 Notwithstanding the possibly broader concept related to the term “smart appliance”, a smart appliance under
 247 the framework of this standard must be understood as follows:

- 248 1) It is an appliance that is able to respond to an external stimulus initiated by a CCM and/or Remote
 249 Agent to provide activities amongst others like
- 250 a. energy related demand response (supporting flexibility) or demand side management
 251 (adaptation of load)
 - 252 b. job status related functions like starting, stopping, pausing,
 - 253 c. content or level related functions like temperature, doorstatus,
- 254 2) The appliance will respond when user set conditions, and its status allow for a response,
- 255 3) The response is a change of the appliance’s behavior like electricity consumption, job status and/or
 256 level or content pattern or a notification of,
- 257 4) The specific technical smart capabilities do not need to be activated when the product is placed on the
 258 market; the activation can be done at a later point of time by the consumer or a service provider.

259 Smart appliances in this context are able to communicate through a Customer Connectivity (&Energy)
 260 Manager (CCM) function processing external signals such as price information or Renewable Energy Sources
 261 availability (demand response) or direct control signals (demand side management), being able to take into
 262 account households’ preferences or the behavior of the other home appliances.

263 Note 1 to entry: This definition is required for consistency with the logical architecture illustrated in section 4.2.
 264 It is consistent with the definition IEC/ISO 15067-3 Edition 1.0 2012-07 IEC 16067:3 –“Smart Appliance - home
 265 appliance that exchanges command and control data with other units on a home area network” in that the
 266 presence of a DCM is taken to signify the presence of such a capability.

267 **3.1.7**
 268 **Customer Connectivity (& Energy) Manager (CCM), see also section 4.2**
 269 component or set of functions with the capability to:

- 270 1) Receive and process Grid Information, Appliance Information and User Instructions, and
 271 2) Manage one or more Smart Appliances.

272 Note 1 to entry: A CCM may be integrated with a Smart Appliance, or may be physically separate.

273 Note 2 to entry: A CCM manages the energy-using behaviour of a Smart Appliance as well as other aspects
 274 of device behaviour (e.g. setting of job status like starting, stopping, pausing, parameters like temperature,
 275 notifications...).

276 **3.1.8**
 277 **Customer Energy Manager (CEM), see [4] and [5]**
 278 CEM is equivalent to CCM but focussing only on Energy.

279 The Smart Grid Coordination Group defined the CEM within the European Mandate M490. M490 focusses
280 purely on Energy → Customer **ENERGY** Manager.

281 CCM uses the CEM idea and structure, however, the CCM allows management of additional functionalities
282 next to energy management

283 3.1.9

284 **Device Connectivity (&Energy) Manager (DCM), see also section 4.2**

285 component or set of functions with the capability to:

286 1) Receive and process information from a CCM,

287 2) Manage one appliance.

288 Note 1 to entry: A DCM may be integrated with an Appliance, a CCM or be physically separate.

289 Note 2 to entry: A DCM enables an Appliance to become a Smart Appliance. It enables communication
290 with a CCM. Thus, DCM and Appliance manage the behaviour of a Smart Appliance.

291 3.1.10

292 **Smart Appliance Information**

293 information received by a CCM directly from or relating to a Smart Appliance.

294 Note 1 to entry: Such information may include (but is not restricted to) the following categories:

295 - status (e.g. whether an appliance is on, off, heating, spinning etc);

296 - electricity load (kW) or energy used over specified period (e.g. kWh/ 30 min);

297 - expected end time of current operating cycle or expected/programmed start/end of next cycle;

298 - expected power profile of the programme selected by the User.

299 3.1.11

300 **Smart operation**

301 Operation of an Appliance where the CCM or DCM has been set to modify operation automatically in
302 response to Trigger Criteria

303 Note: Smart operation may be initiated by a CCM, a DCM or an authorised Remote Agent. The trigger
304 criteria for Smart Operation may be selected or set by the User, the CCM, the DCM or an authorised
305 Remote Agent.

306 3.1.12

307 **Remote Agent**

308 An entity other than the user that is capable of communicating with a CCM or a Smart Appliance.

309 3.1.13

310 **Remote Agent instructions**

311 Commands, instructions and preferences transmitted by a remote agent to a CCM, with the aim of modifying
312 the operation of one or more Smart Appliances.

313 Note 1 to entry: Remote Agent Instructions may aim to modify operation by altering control settings
314 (e.g. switch an appliance to half load) by programming Trigger Criteria (e.g. 'stop operating when
315 energy price exceeds this threshold') or other means.

316 Note 2 to entry: The method of transmission of the instructions is outside the scope of this document
317 series.

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- 318 **3.1.14**
 319 **grid information**
 320 information received by a CCM directly from or relating to the electricity grid.
- 321 Note 1 to entry: Such information may include (but is not restricted to) the following categories:-
 322 current and future energy prices;
- 323 - current and future network constraints;
- 324 - emissions-intensity of electricity supply,;
- 325 - level of renewable energy generation;
- 326 - requests or instructions for load modification;
- 327 - directly sensed information (e.g. frequency and voltage).
- 328 **3.1.15**
 329 **JWG (Joint Working Group)**
 330 Joint working Group Use Cases & Requirements is a working group under the roof of IEC TC57 WG21. It is a
 331 cross functional working group and develops Smart Grid and Smart Home&Building related user stories and
 332 use cases. See IEC TR 62746-2:2015 Use cases & requirements [2]
- 333 **3.1.16**
 334 **Use Case Functions**
 335 Use Case Functions group basic functionalities that had been derived from use cases. These functions
 336 provide the entire information exchange required to implement the considered use cases and user stories.
- 337 **3.1.17**
 338 **Power Profile**
 339 expected variation in power or energy over the duration of an operating cycle.
- 340 Example: May be expressed as energy used during each operation (e.g. kWh during water heating
 341 phase, kWh during main wash, kWh during rinse etc), as peak power achieved during each operation
 342 etc.
- 343
- 344 **3.1.18**
 345 **SPINE Data Model (Smart Premises Interoperable Neutral-Message Exchange)**
 346 SPINE Data Model describes the concepts to ensure information exchange between devices like Smart
 347 Appliance and CCM, comprising
- 348 1) SPINE message framework description, defining the message structure
- 349 2) SPINE Feature Types, describing the specific information to be exchanged
- 350 **3.1.19**
 351 **Neutral Message**
 352 message that doesn't support a certain group. It takes effect on all groups in equal matter (www.answers.com)
 353 – What is a neutral message ?)
- 354 **3.1.20**
 355 **DeviceType**
 356 specific type of physical device ("Washer", "HeatPump", "FridgeFreezer", etc.).
- 357 **3.1.21**
 358 **Entity (logical entity instance)**
 359 logical unit/instance that can collect features or other entities and is also used as SPINE address part for the

- 360 **3.1.22**
 361 **EntityType**
 362 specific type of logical device ("Freezer" is one logical part of a physical device "FridgeFreezer").
- 363 **3.1.23**
 364 **Feature (address information)**
 365 holds one or more functions and is also used as SPINE address part for (logical) feature.
- 366 **3.1.24**
 367 **FeatureType**
 368 specific type that states the function set / class, used on this address.
- 369 **3.1.25**
 370 **node**
 371 Common term for a SPINE instance that has a SPINE address. Dependent on the situation a node can be
 372 either a device or an entity (of a specific device) or a feature (of a specific device-entity).
- 373 **3.1.26**
 374 **role**
 375 each SPINE Feature has a Role, usually either Server (data owner) or Client.
- 376 **3.1.27**
 377 **XSD (XML Schema Definition)**
 378 purpose of an XSD schema is to define and describe a class of XML documents by using schema
 379 components to constrain and document the meaning, usage and relationships of their constituent parts:
 380 datatypes, elements and their content and attributes and their values, see [15].
- 381 **3.1.28**
 382 **XML (Extensible Markup Language)**
 383 Extensible Markup Language (XML) is a simple, very flexible text format derived from SGML (ISO 8879). See
 384 [16]. Extensible Mark-up Language (XML) defines a set of rules for encoding documents in a format that is
 385 both human-readable and machine-readable, enabling multiple publishing options and other applications for a
 386 variety of different purposes
- 387 **3.2 Abbreviations**
- | | |
|------|---|
| AC | HVAC mobile device Air Conditioner |
| DW | Dishwasher |
| FR | Refrigerator-Freezer |
| FZ | Freezer |
| GO | Gas Oven |
| GT | Gas Cooktop |
| HB | Hobs |
| HD | Hood |
| HVAC | Heating, Ventilation, Air Conditioning |
| IH | Induction Hobs |
| MID | Message Interaction Descriptor |
| MW | Microwave Oven |
| OV | Electric Oven |
| RE | Refrigerator |
| RG | Range Cooker |
| ST | Steam Oven |
| TD | Tumble Dryer |
| WC | Winecabinet |
| WD | Washer Dryer |
| WHI | Instantaneous Water Heater |
| WHS | Storage Water Heater |
| CCM | Customer Connectivity (&Energy) Manager |

DCM Device Connectivity (&Energy) Manager
 JWG Joint Working Group
 TC Technical Committee
 TS Technical Specification

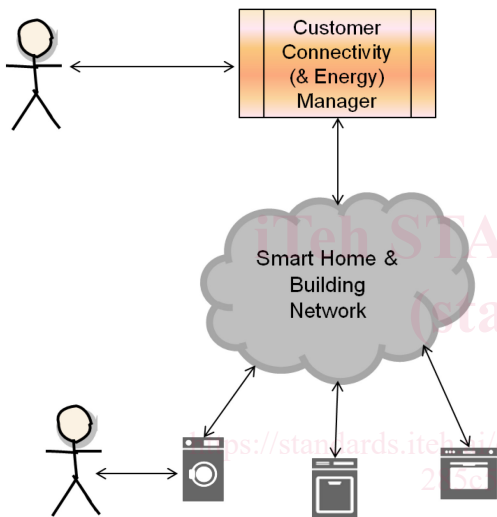
388

389 **4 Process & Requirements to enable interoperability**

390 **4.1 Introduction**

391 The success of the Smart Grid and Smart Home approach is very much related to interoperability,
 392 which means that all Smart Appliances in a Smart Grid & Home Environment manufacturer- and
 393 brand-independent have a common understanding of messages and data in a defined interoperability
 394 area (in a broader perspective, it doesn't matter if it as an energy related-, a home management- or
 395 an information message).

396

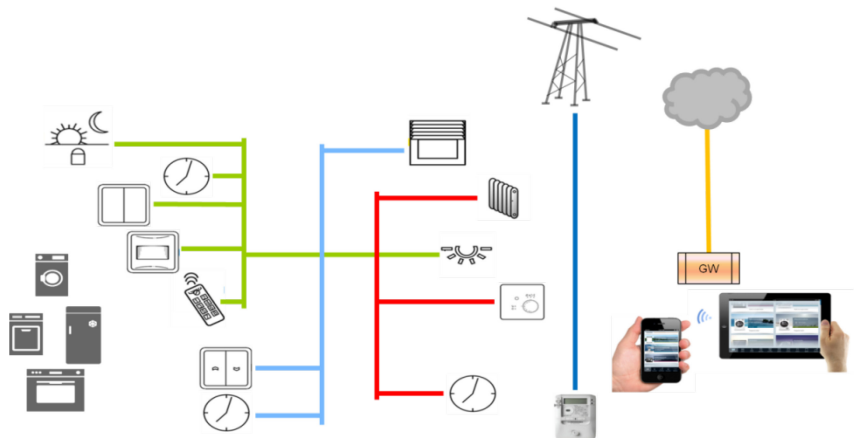


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398

Figure 1: Interoperable home management approach

399 In contradiction, today's premises are covered with different networks and stand alone devices.



400

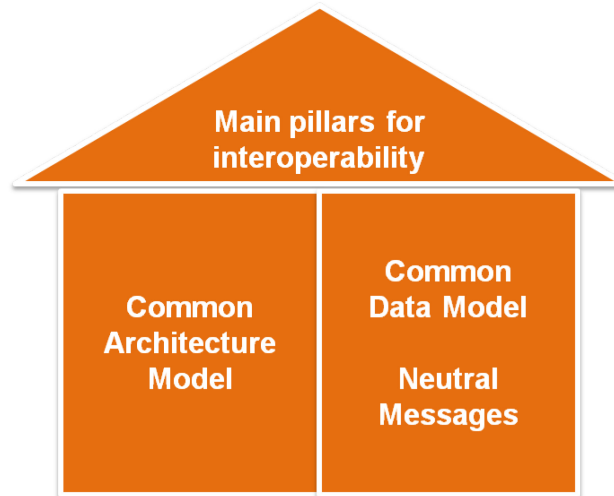
401

Figure 2: Network structure as of today

402 The intention of this document is to describe the main pillars of interoperability, a set of neutral
 403 messages for information exchange, based on common Smart Appliance relevant user stories and

404 use cases, and the mapping onto existing and upcoming communication technologies to enable
 405 interoperability within a Smart Grid, Smart Building and Smart Home area.

406 The following figure presents the main pillars to ensure interoperability.



407

408

Figure 3: Main pillars to ensure interoperability

- 409
- 410
- 411
- 412
- 413
- Interoperability in this context means the definition of a set of messages to allow a common behavior of Smart Appliances on main features or functionalities in a Smart Home environment, agreed by all manufacturers.
 - Interoperability does not include the definition of common algorithms, e.g. on how to manage intelligent, user behavior (user interface) or other aspects influencing competition!

414

415

4.2 Conceptual Architecture Model

416 The concept used in this document is the definition of a common set of neutral information and corresponding
 417 messages. These messages can be used to exchange information between CCM and Smart Appliance
 418 enabling certain behaviour like pausing a washing cycle or exchanging information like remaining time of the
 419 washing cycle.

420 As there are already different network technologies existing in homes and buildings, these messages possibly
 421 need to be mapped to these Domain specific Protocols. However the meaning of information remains the
 422 same.

423