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| D2.1 | CRML specification |
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| Type[[2]](#footnote-2): | **Report** |
| Version: | **1.0** |
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| Environment for model-based rigorous adaptive co-design and operation of CPS | |
| **Executive summary[[4]](#footnote-4):**  This deliverable is the first version of the specification for the Common Requirement Modelling Language.  The objective of CRML is to provide a language close to natural language for the formal capture and simulation of requirements expressed as spatiotemporal constraints on physical objects that constitute large cyber-physical systems such as energy systems (power grids, heat networks, cities…), or transportation systems.  CRML is a functional language, i.e. a language to define library of functions in order to capture temporal requirements on objects, such as “Any pump of the cooling system should not be started more than twice in a sliding period of one month, and the startup delay should be less than 30 seconds”.  The first version of the CRML specification covers the following aspects of the language:   * Definition of functions (called operators in the language) * Definition of objects (as instances of classes) * Definition and operations on sets of objects * Definition and operations on events and clocks * Definition and operations on time periods * Definition and operations on requirements and 4-valued Booleans * Definition of physical quantities   In addition, the first version of the CRML specification provides the following function libraries:   * ETL: operators for the evaluation of requirements * FORM-L: operators for the definition of requirements inspired from the FORM-L language (part of the EDF background of the EMBRACE project).   These two libraries have been prototyped in a Modelica library called CRML.mo in order to validate the main principles of CRML, in particular to verify that functions can be properly combined to form requirements, and that the CRML expressions can be correctly evaluated. CRML.mo will be used to validate the code produced by the CRML compiler (deliverable D2.3).  The first version of the CRML specification is expressed in a set of slides that can be found in file EMBRACE\_D2.1 CRML specification v1.0.pptx.  The specification is expressed using two notations:   * Mathematical notation * CRML language notation   The objective of the mathematical notation is to provide a precise formal semantics of the language, which is mainly based on a 4-valued Boolean algebra.  The objective of the CRML language notation is to provide the ability to use sentences close to natural language instead of using abstract mathematical notation to express requirements. | |

**Deliverable Contributors:**

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# Abbreviations

List of abbreviations/acronyms used in document:

**Abbreviation Definition**

CRML Common Requirement Modelling Language

ETL Extended Temporal Language

FORM-L Formal Requirement Modelling Language

# Deliverable files

The first version of the CRML specification can be found in file ‘EMBRACE\_D2.1 CRML specification v1.0.pptx’. The Modelica prototype of CRML can be found in file CRML.mo.

Both files are not meant for public release before the end of the EMBRACE project.

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1. Access classification as per definitions in PCA; PU = Public, CO = Confidential. Access classification per deliverable stated in FPP. [↑](#footnote-ref-1)
2. Deliverable type according to FPP, note that all non-report deliverables must be accompanied by a deliverable report. [↑](#footnote-ref-2)
3. Due month(s) according to FPP. [↑](#footnote-ref-3)
4. It is mandatory to provide an executive summary for each deliverable. [↑](#footnote-ref-4)
5. Indicate Main Author(s) with an “X” in this column. [↑](#footnote-ref-5)
6. Deliverable leader according to FPP, role definition in PCA. [↑](#footnote-ref-6)
7. Person(s) from contributing partners for the deliverable, expected contributing partners stated in FPP. [↑](#footnote-ref-7)
8. Typically person(s) with appropriate expertise to assess deliverable structure and quality. [↑](#footnote-ref-8)
9. Status = “Draft”, “In Review”, “Released”. [↑](#footnote-ref-9)