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| Nº | EU-TRL  | **Extended TRL** | **Hardware Description** | **Software Description** | **Criterio de salida** |
| 1 | Basic principles observed | Basic principles observed and reported | Initial level of technology. Scientific research begins to translate into applied research and development (R&D). It is made up of theoretical studies or analysis of the basic properties and benefits of the technology. | There is scientific knowledge that bases the properties of software architecture and mathematical formulatio. | The research results underlying the proposed concept/application have been published in prestigious scientific journals. |
| 2 | Technology concept formulated | Technology concept and/or application formulated | The invention begins, this is the R&D activity itself. Concrete applications are designed based on the basic principles observed. These are purely speculative applications, in which there does not have to be detailed demonstrations or analyzes to justify them. These are analytical studies. | The practical application has been identified, but speculatively; There is no experimental evidence or detailed analysis to support the conjecture.The basic properties of algorithms, representations and concepts have been defined. The basic principles have been codified. The result has been tested with simulated data. | Documented description of the application/concept addressing feasibility and improvements or benefits. |
| 3 | Experimental proof of concept | Critical function analyzed and tested or proof of concept demonstrated experimentally | Effective R&D begins. It includes both analytical studies to establish the technology in an appropriate context and laboratory tests to physically validate that the analytical predictions are correct. The different components are not yet integrated or representative. These studies and validation experiments should constitute a "proof of concept" of the applications/concepts formulated in TRL 2 | Development of limited functionality to validate critical properties and predictions using non-integrated software components.components. | Documentation of resultsanalytical or experimental tests that validate predictionsrelating to key parameters. |
| 4 | Technology validated in lab | Component and/or breadboard validation in laboratory environment | The basic technological components are integrated to establish how they will work together with adequate performance. Validation must be designed to support the concept formulated in previous phases and, at the same time, be consistent with the requirements of potential applications of the system. These are representative prototypes of the final system, but without faithfully incorporating the final design elements. May include ad hoc hardware integration in the lab. | Key, functionally critical software components are integrated and functionally validated, to establish their interoperability and initiate architecture development. Relevant environments are defined and performance in this environment is estimated. | Documented test of performance demonstrating compliance with analytical predictions. Documented definition of the relevant environmen.definition of relevant |
| 5 | Technology validated in relevant environment (industrially relevant environment in the case of key enabling technologies) | Component and/or breadboard validation in relevant environment | The approximation of the prototype to the final system increases significantly. The basic technological components are integrated with reasonably realistic supporting elements to be examined in a simulated environment. These are prototypes that integrate components into support systems similar to the final realization of the system. | End-to-end software components are implemented and interconnected withexisting systems or simulations depending on the target environment. The complete software system is tested, in a relevant environment, meeting the expected expectations. The expected operating performance is established. Implementation prototypes are developed. | Test documentation demonstrating performance in line with analytical predictions. Documentation of the definition of escalated requirements. |
| 6 | Technology demonstrated in relevant environment (industrially relevant environment in the case of key enabling technologies) | System or subsystem model or prototype demonstration in a representative environment | A representative system model or prototype is tested in a relevant environment. It is an important step in the evolution of TRL. Includes testing of a prototype of the system in a representative laboratory environment or in a simulated operating environment. | Prototype implementations of the software tested and demonstrated on realistic, full-scale problems. Partially integrated with real hardware/software systems. A limited level of documentation is available. Technical feasibility is fully demonstrated. | Test documentation demonstrating performance in line with analytical predictions. predictions.  |
| 7 | System prototype demonstration in operational environment | System prototype demonstration in a real operating environment | Prototype of the real system running in the intended real operating environment. Requires the demonstration of a real, faithful prototype of the system in an operational environment (for example, in an airplane, in a vehicle, or in space). | A software prototype is built with all key functionalities and is available for demonstration and testing. A realistic integration with Hw/SW systems must be produced to demonstrate operational viability. Major software bugs are debugged. A limited level of documentation is available.Limited documentation available. | Test documentation demonstrating performance in line with analytical predictions. predictions. |
| 8 | System complete and qualified | Complete system certified through tests and demonstrations | The technology has demonstrated that it works in its final form, at the system level and under the intended conditions. In general, this TRL represents the end of system development. It should include testing of the entire system and evaluation of compliance with design specifications. May include the integration of new technologies into an existing system. | The software has been completely debugged and fully integrated with the operational hardware and software systems. User, training and maintenance documentation is completed. All functionalities satisfactorily demonstrated in simulated operational scenarios. Verification and Validation (V&V)completed.  | Test documentation that verifies analytical forecasts. Certifications. Product documentation, training, maintenance, etc |
| 9 | Actual system proven in operational environment (competitive manufacturing in the case of key enabling technologies; or in space) | System tested successfully in real environment | Demonstration of a complete mission of the system in its final form and under real conditions. Use of the system in operational mission conditions. Example: qualification flight. | The software has been completely debugged and fully integrated with the operational hardware and software systems. All documentation has been completed. Software support engineering is operational. The system has been run and operated successfully in the real operating environment. | Documentally proven operational results of the mission. operational results. |