CEN/CLC/JTC 22/WG 3 "Quantum Computing and Simulation"
WG Secretariat: **AFNOR**
Convenor: **Lefebvre Catherine Mrs**

CEN-CLC-JTC 22-WG 3_20230728_finalNewWorkItemproposalform_LayerModel

Document type	Related content	Document date	Expected action
Meeting / Document for information	Meeting: VIRTUAL 31 Aug 2023	2023-08-16	**INFO**

New Work Item Proposal	
* to be attached to the CIB	
CEN/CENELEC JTC 22 – Quantum Technologies	
Secretariat: DIN	Proposal documented in N xx
Date of circulation:	Closing date for voting:
Decision reference:	Decision date:

Proposal

0. This proposal relates to

☒ the adoption of a New Work Item in the committee's work programme (stage 10.99)
☐ the adoption of a Preliminary Work Item in the committee's work programme (stage 00.60)
☐ the activation of a Preliminary Work Item in the committee's work programme (stage 10.99): PWI *XXXXX*

1. Deliverable

☐ European Standard (EN)
☐ Technical Specification (TS)
☒ Technical Report (TR)

2. This item corresponds to

☒ A new project
☐ An amendment to the EN *XXX*
☐ The revision of EN *XXX*
☐ The conversion of TS *XXX* into an EN *XXX*
☐ The revision of TS *XXX*
☐ The revision of TR *XXX*

2.1 - Only for WIs of CEN/TCs (not applicable to CEN-CLC/JTCs WIs): if this item corresponds to an amendment/revision of an EN indicate if:

☐ the scope will change (weighted vote required - select the right option in the CIB)
☐ the scope will not change (simple majority vote required - select the right option in the CIB)

3. Explain the purpose and give a justification for this proposal (max 4000 characters). This text should provide information on technical topics to be discussed.

A layer model for quantum computing is an abstract description of a quantum computing system via a common stack of layers. The layer model slices down the overall complexity into two main layer models of addressing the whole quantum computing system. The lower of the two main layer models addresses mainly hardware, and it is dependent of the physical platform. The upper main layer model addresses mostly software, and it aims to be hardware agnostic. By agnostic we mean that the system works on different quantum computing hardware platforms such as: solid state quantum computing; atoms, ions and molecules optical quantum computing and topological quantum computing. Each of these two main layer models comprises many inner layers.

The first purpose is to define a common language that will be used to describe the features and functional requirements for each layer of the stack of a quantum computer and their interfaces. Another purpose is to analyze and describe the interaction between the layers. These are essential steps towards interworking between modules from different origins through well-defined interfaces. The functional description of each layer should offer sufficient guidance on where a desired functionality should be described, and what kind of exchange is needed with other modules through the interfaces. The boundaries between the layers are natural locations for such interfaces. Correctly defining such boundaries requires careful analysis of the interaction between the layers.

The details of a layer model will probably be matured over time and the involved Technical Report (TR) is expected to be upgraded into future revisions. A first version of such TR is available as the consensus layer model that has been developed by FGQT from CEN/CENELEC and described in its roadmap document. An image of the associated layers has also been provided in CEN-CLC-JTC 22_N13. Views from other publications are not excluded from developing a consensus layer model.

This TR will develop and adopt a single generic layer model and use it as a reference, which will help other work items. A layer model is also important to offer a convenient structure for demarcating the scope of (future) sub-standards. It allows for developing those documents near-independently by a dedicated team of experts while maintaining coherence with other work items. Because of this relevance, it is proposed to take the layer model from FGQT as a starting point, compare it to other existing other publicly available layer models, and produce from that a first version of the document. This first version is to be restricted to *functional* requirements only, to prevent over-specification of layers in the present (early) phase of quantum computing.

4. Titles

English title: Layer model of Quantum Computing

French title:
(*Optional*)

German title:
(*Optional*)

5. Scope of the proposed work item (max 4000 characters)

This document describes a layer model that covers the entire stack of a quantum computer. The group of lower-level (hardware) layers are organized in different hardware stacks tailored to different hardware architectures, while the group of higher-level (software) layers are built on top of these and expected to be common for all quantum computing systems. The higher-up in the stack, the more agnostic it will be from the underlying hardware. Reducing the dependencies between higher and lower layers is a crucial point for optimised quantum computations.
This document is limited to a high-level (functional) description of the layers involved. Additional details of the individual layers will be described in other, future, CEN/TRs.

6. Digital aspects

☒ The deliverable is intended to be developed using the Online Collaborative Authoring platform

☐ The deliverable is intended to include non-Word/PDF content, e.g. audio files, XML schemas, machine-readable formats or software.
Please provide details of the non-Word/PDF content:

☐ None of the above.

If yes to either of these questions, CCMC will contact you for feasibility and organizational aspects.

7. Stakeholder categories immediately affected by the proposal

☒ Industry and commerce	☐ Societal consumer groups	☒ Standards application
☒ SMEs	☐ Labour	☐ Non-governmental organization (NGO)
☒ Government	☒ Academic and research bodies	☐ Environmental stakeholders
☐ Consumers		
☐ None of the above categories		

8. How will these Stakeholders benefit from or be impacted by the proposed deliverable?

The proposed technical report significantly impacts quantum computing stakeholders such as academia, technological actors (startups, spin-offs, SMEs, big tech), industries and governments.

Adopting quantum computing from the stakeholder point of view and market point of view means a clear and comprehensive standardized layer model of the quantum computing system. This will clarify to the relevant stakeholder the modules and components required for its specific usage and will speed up the development of the quantum computing system ready for the end user. The development of the layer model will stimulate a global market and end the multiple local and even company-wise models, which create a plethora of uncomprehensive local markets and therefore damage the adoption of quantum computing.

9. Document developed in drafting body

☒ Existing drafting body *(please give name and title)*:
CEN-CENELEC JTC22 on Quantum Technologies – WG3 on Quantum Computing.

☐ New drafting body *(please give name and title)*:

10. Proposed Project Leader (including contact details) - *Optional*

Rob F.M. van den Brink – Netherlands – Rob.vandenBrink@Delft-Circuits.com

11. United Nations Sustainable Development Goals (SDGs)

Please select any United Nations Sustainable Development Goals (SDGs) that this document will support. For more information, please visit the SDG section of the CEN website (currently under development).

☐ **GOAL 1:** No Poverty
☐ **GOAL 2:** Zero Hunger
☐ **GOAL 3:** Good Health and Well-being
☐ **GOAL 4:** Quality Education
☐ **GOAL 5:** Gender Equality
☐ **GOAL 6:** Clean Water and Sanitation
☐ **GOAL 7:** Affordable and Clean Energy
☐ **GOAL 8:** Decent Work and Economic Growth
☒ **GOAL 9:** Industry, Innovation and Infrastructure
☐ **GOAL 10:** Reduced Inequality
☐ **GOAL 11:** Sustainable Cities and Communities
☐ **GOAL 12:** Responsible Consumption and Production
☐ **GOAL 13:** Climate Action
☐ **GOAL 14:** Life Below Water
☐ **GOAL 15:** Life on Land
☐ **GOAL 16:** Peace and Justice Strong Institutions
(N/A **GOAL 17:** Partnerships to achieve the Goal)
☐ None of the above

Proposed rationale for the selected SDG(s)- (optional):

12. Accessibility aspects

See CEN-CENELEC Guide 6:2014 'Guide for addressing accessibility in standard'

☐ Accessibility aspects are relevant for this NWI *(please indicate which ones):*
See the 'protocol' to help you decide when accessibility following a Design for All approach is relevant:
https://www.cencenelec.eu/areas-of-work/cen-cenelec-topics/accessibility/design-for-all/

☒ Accessibility aspects are not relevant for this NWI
Please provide a written explanation detailing why accessibility aspects do not apply to the current proposed WI:

The deliverable itself is a TR, developed in an accessible way like any other CEN-CENELEC TR. The content of the TR will not affect any accessibility aspects (i.e. 24x "no" to the questions from "The Protocol Form")

13. Environmental aspects

☐ Discharges to soil	☐ Discharges to water	☐ Emission to air
☐ Heat	☐ Noise/Vibration	☐ Use of land
☐ Radiation	☒ Use of energy	☐ Other effects on biodiversity
☒ Use of material	☐ Use of water	☐ Waste
☐ Risk to the environment from accidents/misuse		☐ Chemicals

☐ Other:

☐ None of the above.
Please provide a written explanation detailing why these environmental aspects do not apply to the current proposed WI:

14. How do you plan to address these environmental aspects?

☐ Bring in environmental expertise to the WG

☐ Contact EHD for help/support (cen.ehd@cencenelec.eu) and/or use examples from Environmental Framework

https://www.cencenelec.eu/areas-of-work/cen-cenelec-topics/environment-and-sustainability/environmental-helpdesk-and-trainings/

☐ Use of environmental checklist and guides (please visit the dedicated section in the CEN website

☒ Other**:**

Environment aspects are included as part of the analysis, e.g. energy use.

15. Vienna Agreement (parallel procedure)

☒ No or Vienna Agreement with CEN lead proposed

The project focusses in the European perspective. There does not exist a parallel ISO activity on the topic/scope of the project.

☐ Yes – Vienna Agreement Parallel with ISO Lead
ISO project reference:
ISO project ID:
ISO/TC:

16. The project is based on

☒ No document from another organization
It is a natural follow-up from the "Standardization Roadmap on Quantum Technologies" written by the CEN-CENELEC Focus Group on Quantum Technologies (FGQT) during 2021-2023

☐ An ISO or ISO/IEC document (not covered by a parallel procedure)

☐ Identical

☐ Non-identical
ISO/IEC project reference:
ISO/IEC project ID:
Publication date:

☐ A document from another organization than ISO or ISO /IEC:
Note: Please explain the purpose and give a justification for this proposal in Section 3.

☒ The project will make reference to relevant standards from ISO/IEC, ITU-T, ETSI, NIST and other.

17. Please indicate whether the proposed project is linked to a specific European Research and Innovation Project

☐ **No**

☒ **Yes**

QUCATS

18. Track

☐ Enquiry + Formal Vote (for EN)

☒ Vote on TS or TR by correspondence

19. Please provide the target dates for the below key stages.

19.1 – For ENs

N/A

19.2 – <u>For TSs and TRs</u>

<u>Project start date (10.99)</u>	**<u>Dispatch of 1st WD (20.60)</u>**	**Dispatch of draft for Vote (30.99)**
2023-10-15	2023-10-15	2024-03-01

20. Related standardization request(s) (formerly mandate):

☒ No

☐ Yes *(please specify)*:

21. Related directive(s)/regulation(s)

☒ No

	Directive/ Regulation reference	Candidate for citation in Official Journal?
☐ Yes		☐ No ☐ Yes
		☐ No ☐ Yes

22. Relation to other legislation or established public policy.

☒ No

☐ Yes

Please specify which legislation or established public policy is/are in relation with the proposed project:

23. Is the proposed project covered by Intellectual Property Rights (IPR)?

Please indicate whether there is any knowledge of items covered by IPR(s), for instance patents, copyright, trademark, etc.

☒ No

☐ Yes

Please provide full information about these items and the identified IPR(s):

24. Commitment This section applies only to *CEN-CLC/JTC* T*o be completed for NWI request to be approved by CEN and CENELEC BTs.*

The following members (<u>at least five</u>) are committed to participate in the development of the project:

1) Netherlands (contact: Rob.vandenBrink@Delft-Circuits.com)
2)
3)
4)
5)

Interest in this topic has been expressed by the following individuals:

- UK: Gavin Jones
- Finland: Juha Röning
- Italy: Michele Amoretti
- Austria: Angie Qarry
- Germany: Daniel Zeuch