CEN/CLC/JTC 22/WG 3 "Quantum Computing and Simulation"

Convenor: **Paul Alexandra Mme**

Intro Hardware Abstraction Layer (HAL)

Document type	Related content	Document date	Expected action
Meeting / Document for discussion	Meeting: VIRTUAL 25 Nov 2025	2025-11-24	**INFO**

Description

Dear Members,

Please find attached the presentation in the upcoming WG 3 meeting regarding the HAL possible WI.

Kind regards,

Hardware Abstraction Layer (HAL)

Juan Boschero, Rob van den Brink, Michele Amoretti, Valentin Torggler, and Michael Fellner

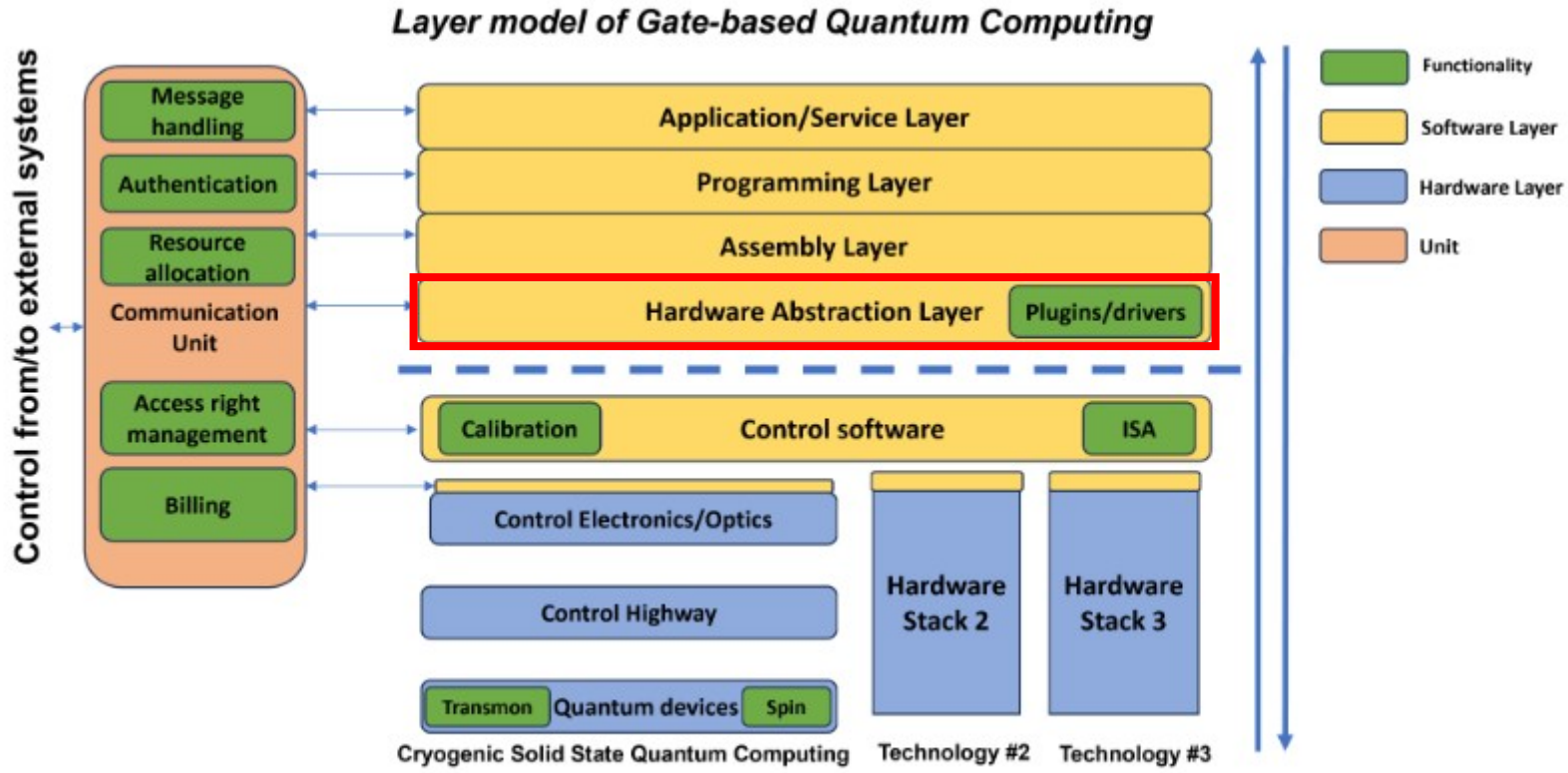
Hardware Abstraction Layer in Context

It should enable the portability of quantum algorithms and libraries across diverse platforms

A good HAL should conceal vendor-specific complexities for a unified experience

Core Functions:

- Translates low-level instructions into vendor-specific commands.
- Manages **resource allocation**, **scheduling**, and provides hardware details (qubit topology, gate sets, error metrics).

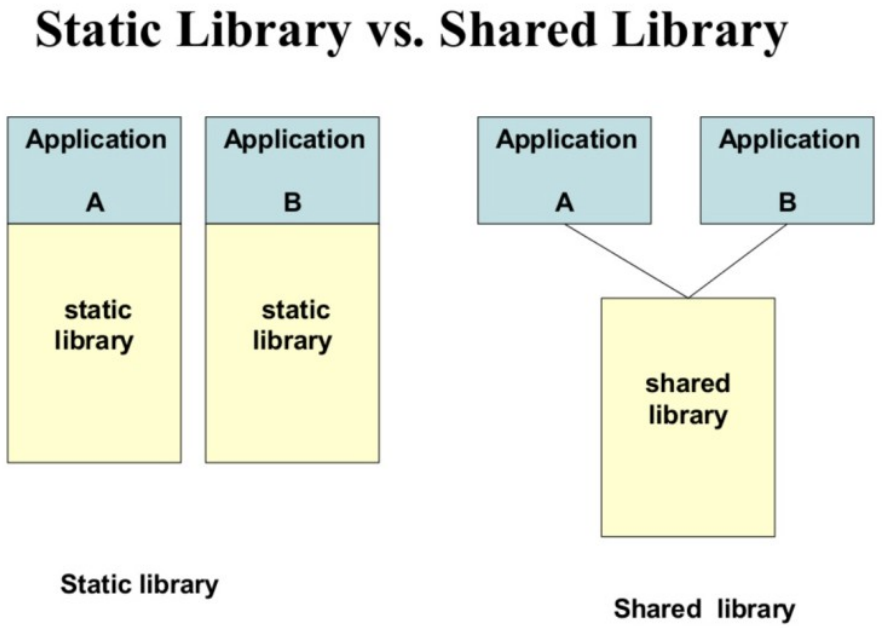


Functionalities: Dynamic Linking

Dynamic linking allows an algorithm, or a collection of packages, to be compiled into, for example, a binary package and be delivered across many providers.

Use cases:

- A proprietary package designed to optimize mapping and routing for variational algorithms written in Qrisp can be compiled and dynamically linked through the HAL, optimizing a user's algorithm written in Q#
- QEC packages offered by hardware vendors that apply specific optimizations for their machines can be linked in compile time via the HAL to optimize a user's program



Currently static linking is used (and linked in the programming layer) but as quantum computing becomes more abstract, this practice will shift.

Functionalities: Virtualization & Resource Management

Virtualization in Quantum Computing

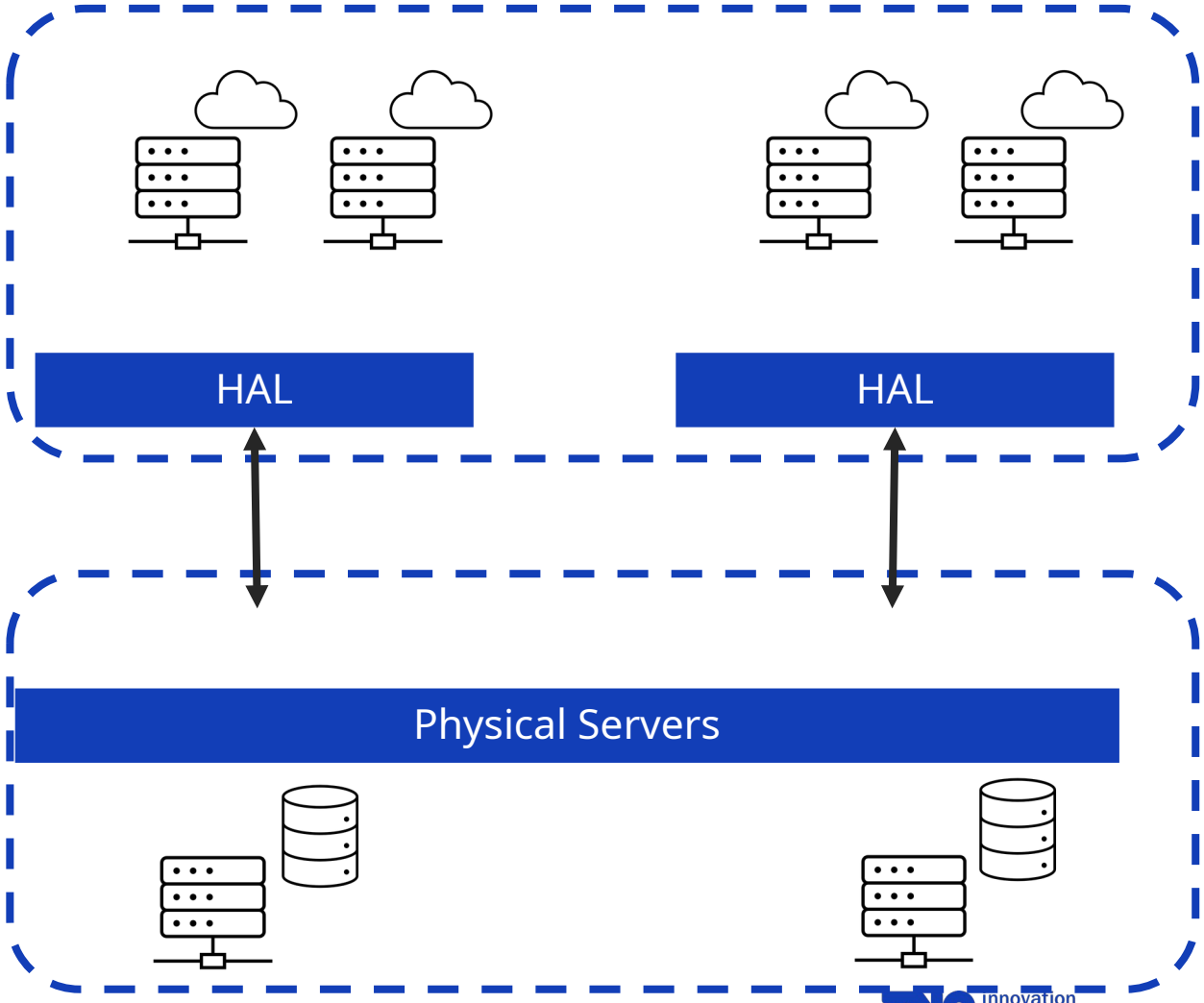
Virtualization enables isolated quantum environments supporting multi-user access without hardware interference.

Dynamic Resource Allocation

Resource manager dynamically allocates qubits, memory, and timing channels based on user needs and constraints.

Scheduling and Performance

Scheduling policies balance throughput and latency to maintain high performance under multi-user demand.



Further work

Are there any missing functionalities?

What is the input & output information required from the HAL?

How does the HAL interact with the communication unit, the control software layer, and the assembly layer?

Create a list of libraries that may be incorporated into the HAL