National Federated Compute Services NetworkPlus

Spring Conference
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Supercomputers and Superpositions

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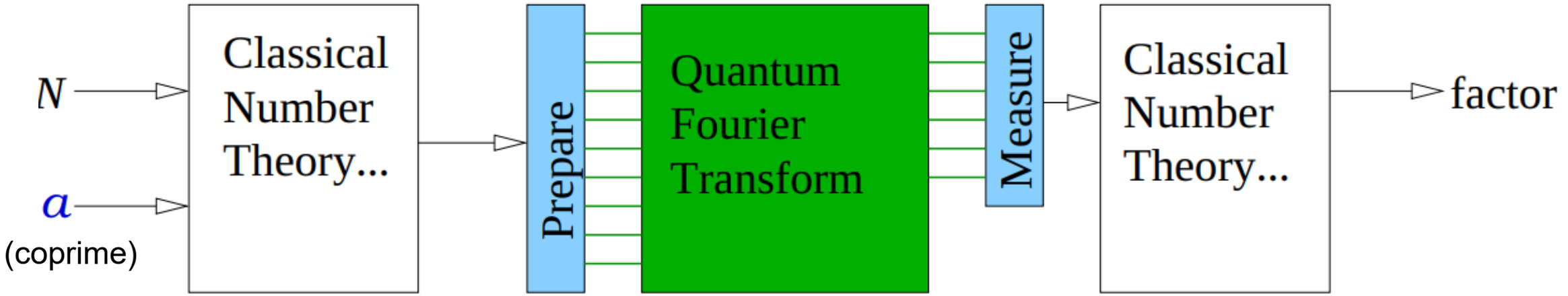
How can we make quantum accelerators accessible within HPC frameworks?

Shor's Algorithm For Factoring



- The difficulty is in finding r, the periodicity of $x^a (mod\ N)$
- This is where Fourier transforms shine
- The QFT is exponentially faster than its classical counterpart
- Once the periodicity is known, the factor can be found with high probability using $a^{r/2} \pm 1$

Why should we care?

Quantum computers will not completely supplant classical

The National Quantum Strategy highlighted a critical skills gap

Current access is fragmented

Many people are interested about "quantum" but don't know where to start

What should we do?

How can we integrate QPUs and CPUs into hybrid frameworks?

Can we equip domain specialists with the skills needed to accelerate their own science?

Can we federate quantum access?

Can we eliminate entry barriers for new users?

Challenges

Technological

Coupling paradigm (tight vs loose)

Hardware interoperability

Software interoperability

Execution models

Latency and synchronization

Unified containers and associated auxiliary protocols

Community

Limited quantum aware talent pool

Gaps at researcher level vs young people

Current access means are usually group specific with niche caveats

Steep learning curve

Stakeholders

We plan to engage with

- **Julich Supercomputing Centre** (JSC): world leading expertise in heterogenous hardware integration, quantum simulators and unified software environments
- **Quarks Interactive**: code-free but scientifically rigorous educational game for non-experts
- **EPCC/DiRAC**: regularly provides training for HPC users already
- **National Quantum Computing Centre**: have agreed to provide funding for community workshops
- **Under-represented communities**: for example schools in North East England

JÜLICH Forschungszentrum

QUARKS INTERACTIVE

epcc UK National Supercomputing Centre

DiRAC

UKRI National Quantum Computing Centre

Structure of the project

WP1 Technology

- Establish a clear, evidence-based view of quantum-HPC integration today and technical gaps that block scalabale, reproducible use

WP2 Community

- Work directly with key communities to identify real barriers to access and co-develop practical solutions

WP3 Governance

- Consolidate insights to highlight priority interventions, compare delivery methods and work towards federated access of quantum resources to diverse groups

Summary

- **Quantum computing has the potential to dramatically accelerate key classical bottlenecks**
- **However, access comes with high entry barriers**
- **We will address both technological and community related challenges**
- **Keep an eye out for our community workshops**
- **Already working on a quantum-HPC session at Durham HPC Days in June**

  (https://hpc-days.github.io/Durham-HPC-Days-2026/)
- **Please contact me if you would like to be involved in any way!**

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