QED-C Technical Advisory Committee QIS Standards and Performance Metrics

Standards TAC Update

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> NOTE: QED-C Internal Document Not for Distribution

Agenda

- 1) Overview of Standards TAC
- 2) What We Accomplished in 2021
- 3) On the Docket for 2022

1) Overview of the Standards TAC - Recap

- Operational now for 3 years and 1 month Started with 9 Members, now at ~80 Members (~25+ active) Over 200 meetings, 80+ in 2021
- Information about the TAC and published reports available on the QED-C Website
- Study the Landscape of Standards Development
 - Connect members with relevant Standards Development Organizations worldwide.
- Identify ways to encourage development of standards and performance metrics to accelerate commercialization of quantum-based products and services.

1) Overview of Standards TAC - What the TAC is Doing

- Monitor and Stay Close to SDO Activities
 - SDO = Standards Development Organization
 - Active Engagements in ITU-T, IEEE, ETSI, ...
 - Work to Provide Input to and Influence SDO Activities
- Organize Sub-Groups to focus on 4 Areas:
 - Quantum Networking
 - Quantum Computing
 - Quantum Sensing (Deferred)
 - Standards Ecosystem (Standardization Readiness Levels)
- Inform QED-C Members about Standards and Business Impact





Standards TAC – Accomplishments 2021

2) Standards TAC - What We Accomplished in 2021

- Developed a robust community (many new TAC members)
- Feedback on Terminology Standards provided to SDOs (ISO/IEC + IEE)
- Multiple Guest speakers (Unitary Fund, CQN, CQC)
- Blog posts (Patents, Standards Ecosystem)
- Quantum Networking ITU-T 5 webinar discussions, QKD group, interoperability group, connected with outside efforts (ATIS Next G Alliance, NIST)
- Standards Ecosystem Task Team Established standardization readiness levels (SRLs), integrity recommendations

2) Standards TAC - What We Accomplished in 2021

• Launched Standards Landscape Visualization Project

- Discussions about Easy-to-use User Interface into Standards Repository for Members and (possibly) public
- Up-to-Date Info about state of Standards Development activities around the world
- Currently lots of information about Standards in a complex hierarchy ...

Documents

QED-C Commentary on Quantum StandardsOctober 8Elliot J. MasonQuantum ComputingJuly 19, 2019Goldstein, Barbara L (Fed)Quantum NetworkingJuly 19, 2019Goldstein, Barbara L (Fed)Quantum VillageOctober 8Elliot J. MasonQuantum VillageOctober 8Elliot J. MasonStandards Development OrganizationsJuly 19, 2019Goldstein, Barbara L (Fed)Standards Visualization-ProjectSdays agoTom LubinskiTAC - Meeting NotesAugust 30, 2019Tom LubinskiTAC - ReferenceDecember 6, 2019Tom LubinskiTAC - ReferenceAugust 30, 2019Tom LubinskiTAC - ReportsAugust 30, 2019Tom Lubinski	\Box Name \vee	Modified \vee	Modified By \vee Statu
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	TAC - Reports	August 30, 2019	Tom Lubinski

2) Standards TAC - What We Accomplished in 2021

- Application-Oriented Benchmarks for Quantum Computing
 - Released Open Source Repository of Ready-to-use Benchmark Programs
 - Produced 30 page paper pushed to arXiv
 - Collaborative Effort involving Multiple QED-C Member Companies
 - Already significant uptake in community



	Qiskit	Cirq	Braket	Q#
Deutsch-Jozsa	Х	Х	Х	WIP
Bernstein-Vazirani	х	Х	Х	WIP
Hidden-Shift	х	Х	Х	
Quantum-Fourier-Transform	Х	Х	х	WIP
Grover's Search	Х	Х	Х	
Hamiltonian Simulation	х	Х	Х	
Phase Estimation	Х	Х	Х	
Amplitude Estimation	х	Х		
Monte Carlo Sampling	х	Х		
Variational Quantum Eigensolver	Х			
Shor's Order Finding Algorithm	Х	WIP	WIP	

Standards TAC – On the Docket for 2022

3) Standards TAC – On the Docket for 2022 (2022 ... can you believe it?)

- Quantum Networking Projects
 - Continue interoperability group (goal: plug-fest) (led by Richard Toohey)
 - Continue QKD group interviews spin-off into Use Cases TAC Communications & Security subgroup (led by John Prisco)
 - Quantum networking demos (QKD Qubitekk, entanglement dist. CQN)
 - Quantum networking simulation software (open source comparison/review)
 - Explore collaborations: ATIS (specific use cases w/Use Cases TAC), NIST (metrics for sources/detectors)
- Standards Ecosystem Analysis Complete (led by Barbara Goldstein)
 - Framework for Standardization Readiness Levels (SRLs)
 - Document with recommendations for integrity in standardization process
 - Follow up with connections made (Denmark, Netherlands, Finland, Sweden)
 - Transition to Quantum Sensing subgroup?
- Additional blog posts: China (recent activity, primer), results of ITU-T Q4NS, Patents update

3) Standards TAC – On the Docket for 2022

- Quantum Computing App-Oriented-Benchmarks Phase 2
 - Consider Ways to Involve SDOs e.g. IEEE
 - Possible Competition to Solicit and Acknowledge Novel Contributions
 - Tighter Integration with Component and System-Level Benchmarks
 - Deeper Analysis of Execution Time and Throughput
 - Extend Suite of Applications and Enhance Sophistication
 - Other Improvements e.g. User Interface
- Possible Inclusion of PIRQ Project
 - Practical Intermediate Representation for Quantum Applications
 - Implement Recommendations from QED-C PIRQ Workshop under the Standards TAC Umbrella

- 3) Standards TAC On the Docket for 2022
 - Develop Standards Landscape Visualization Application
 - Provide Easy-to-use Graphical User Interface into Standards Repository – for Members and (possibly) public
 - Info about state of Standards Development activities around the world – updated regularly by SDOs to keep current



Questions ?