Quantum Internet Hackathon Results

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GRATITUDE

- Big thanks to:

  - QuTech for the idea & content & many hands on deck!

  - Juniper: sponsor of equipment & logistics partner

  - VolksHotel, our venue

  - RIPE NCC colleagues

  - And of course ALL OF THE PARTICIPANTS!!!

  - Thanks to the families who missed us during the weekend, and gave us support to prepare, travel & recover

RIPE NCC Hackathons

- Hack-a-thon = hacking marathon

  - intensive coding on FLOSS (free and open source software)

hacker: n.

[originally, someone who makes furniture with an axe]

1. A person who enjoys exploring the details of programmable systems and how to stretch their capabilities, as opposed to most users, who prefer to learn only the minimum necessary. RFC1392, the *Internet Users' Glossary*, usefully amplifies this as: A person who delights in having an intimate understanding of the internal workings of a system, computers and computer networks in particular.

- Cooperative, collaborative, non-competitive

- Non-commercial: no monetary rewards

Powered by Stroopwafels!

Previous RIPE NCC Hackathons

- labs.ripe.net/hackathons

  - RIPE Atlas DataViz (March 2015, Amsterdam)

  - RIPE Atlas Tools for Operators (October 2015, Bucharest)

  - RIPE Atlas Interfaces (April 2016, Copenhagen)

  - IXP Tools (October 2016, Madrid)

  - IXP Tools Code-Sprint (April 2017, Amsterdam)

  - DNS Measurements (April 2017, Amsterdam)

  - Version6 (November 2017, Copenhagen)

  - Network Operators Tools (June 2018, Dublin)

- All code on GitHub

Quantum Internet Hackathon

- Saturday and Sunday, 13 - 14 October 2018

- Volkshotel, Amsterdam

- 42 participants

- 8 resulting projects

# Goals of the Quantum Internet Hackathon

- Make progress towards Quantum Internet

- Bring together quantum-tech researchers & RIPE community network operators

  - & software developers & hackers & …

- Combine creative skills

- Contribute useful tools for Quantum Tech

- Make new connections

- Continue cooperation

Challenges & Proposals

- "SimulaQron"

  - A: testing the network

    - a network ping (or a quantum version of a ping)

    - visualizing network diagnostics.

  - B: Improving SimulaQron code
  - C: taking QChat to new heights
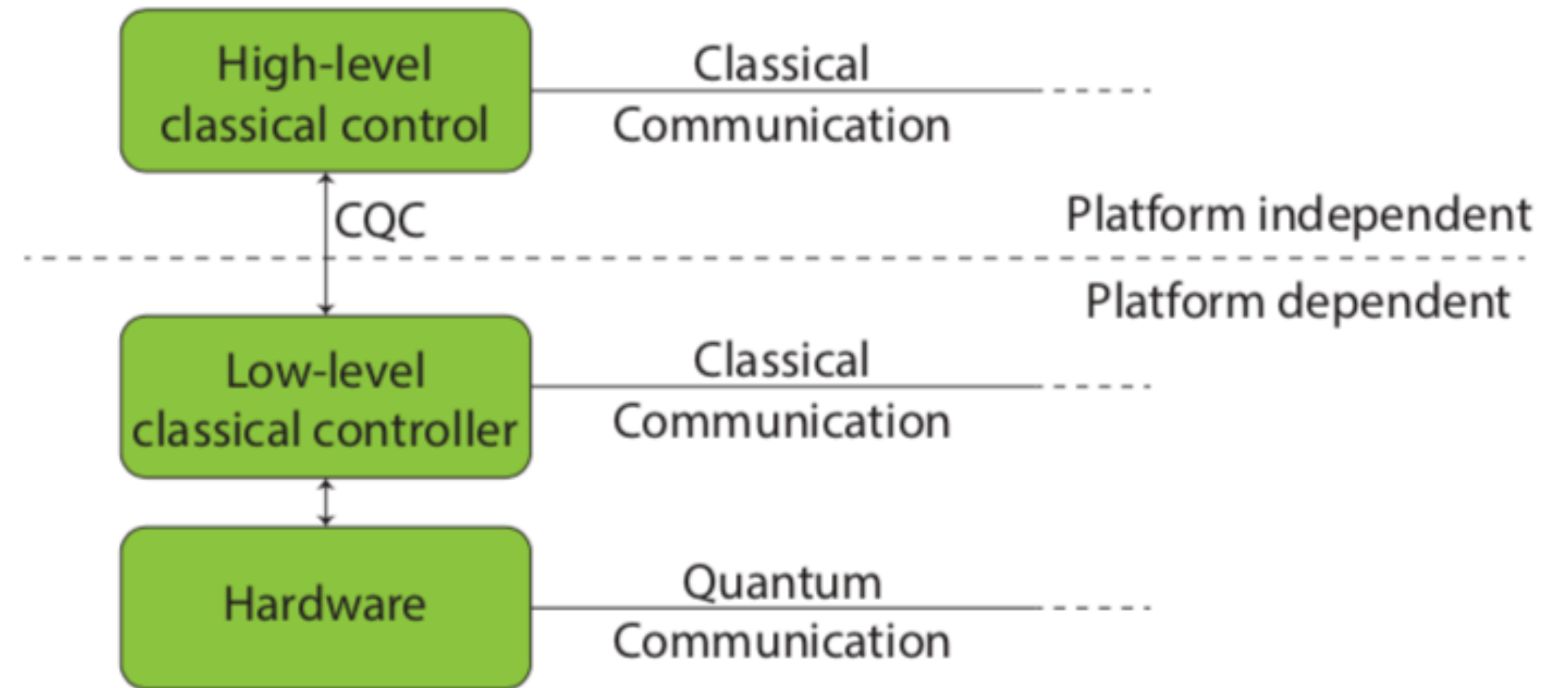
- Implications of quantum internet on routing protocols

- Quantum BitCoin

- Quantum Digital Signature

- Measurement Based Quantum Computation subroutine

Resulting Projects

- Quantum Consensus

- "Advertising Entanglement Capabilities in Quantum Networks"

- QuViz

- Sim-NG

- Qhamster (improvements to Qchat)

- Hanko (Quantum Digital Signature)

- S.O.S. (Steane on SimulaQron)

- aMBiQuiCy

All Results & Presentations are on GitHub

ripe-atlas-community-contrib / quantum-internet-hackathon /

becha42 Add files via upload

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📄 0-quantum-internet-hackathon-intro-and-ComBuild-update.pdf

📄 1-QuantumDisconsensus.pdf

📄 2-AdvertisingEntanglementCapabilitiesinQuantumNetworks.pdf

📄 3-QuViz.pdf

📄 5-qhamster-qchat_improvements.pdf

📄 6-hanko-quantum-digital-signature.pdf

📄 7-TeamS.O.S..pdf

📄 8-aMBiQuiCy.pdf
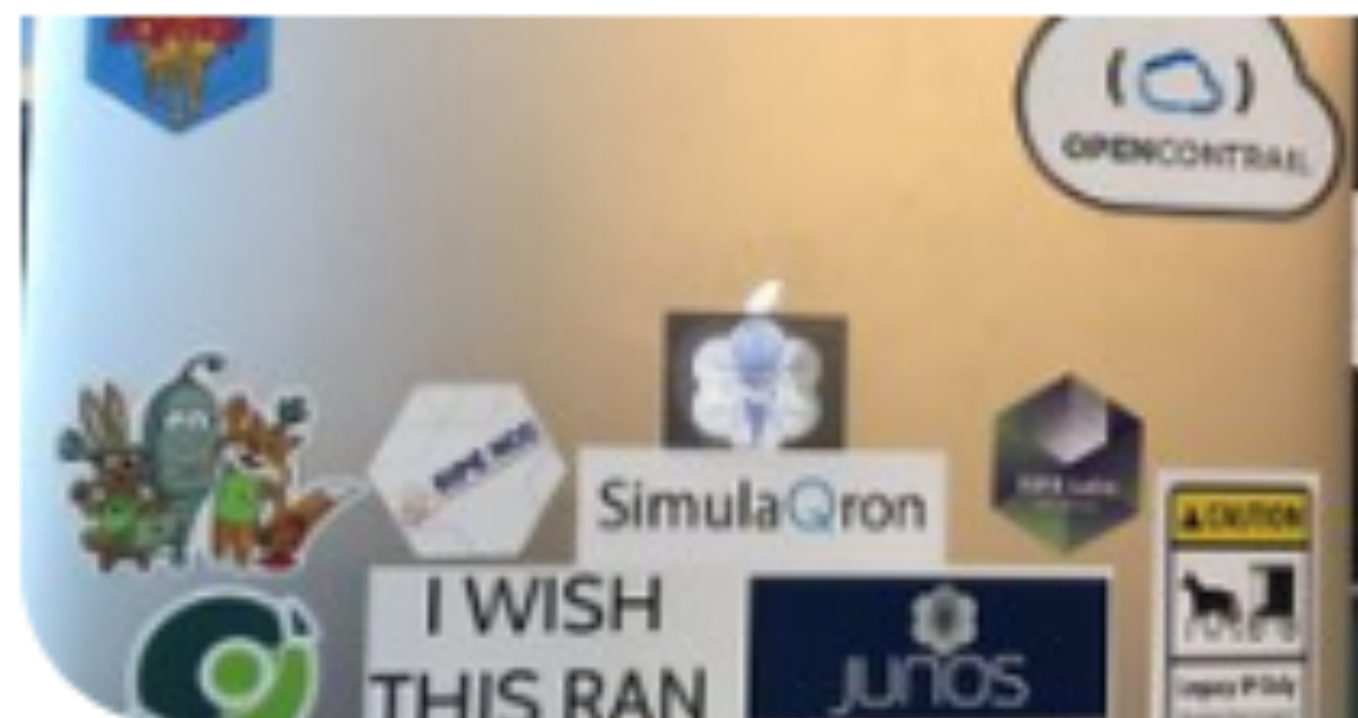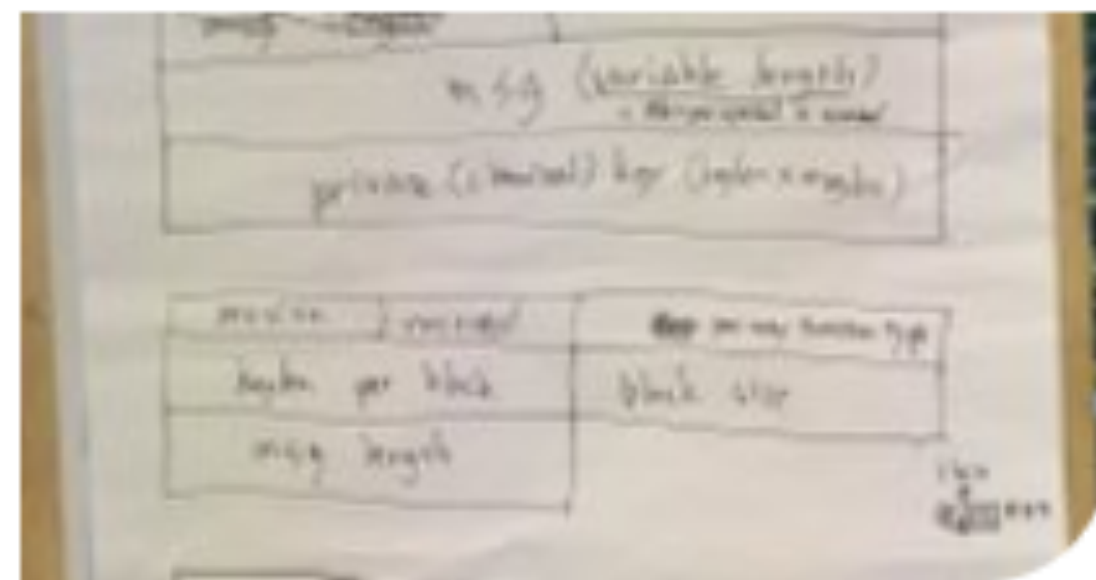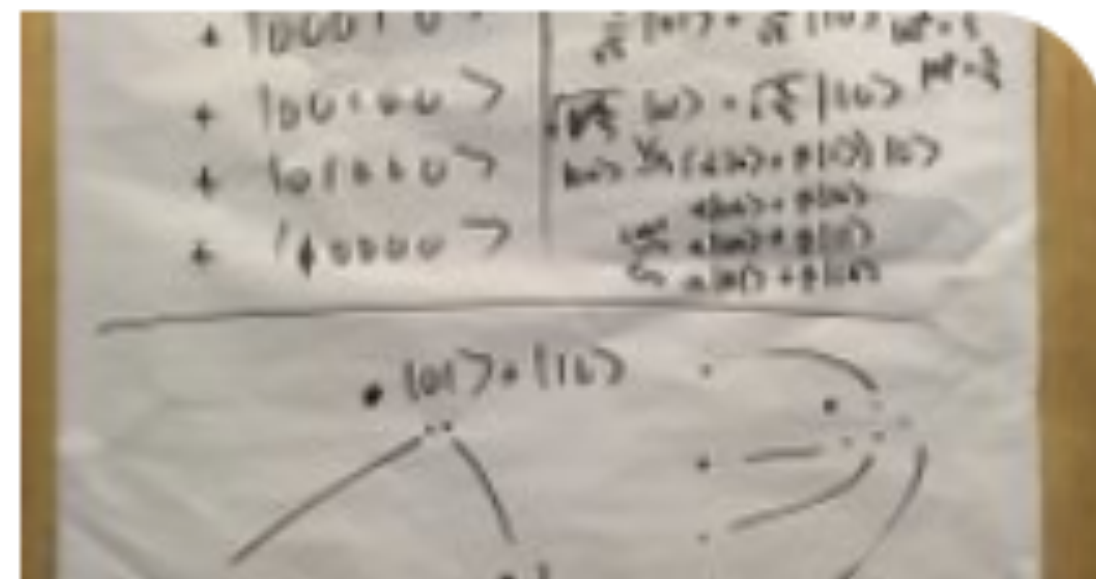
Future Participation in Hackathons

- Use the tools, contribute code improvements on GitHub

- Early call for 2019

  - Two RIPE NCC events planned: Spring and Autumn

  - Be a host / local partner / juror / sponsor / participant

- For Quantum Internet - follow QuTech announcements

- On RIPE Labs: Hackathons Reports & Calendar

  - labs.ripe.net/hackathons

- BECHA@ripe.net

Results
in more detail
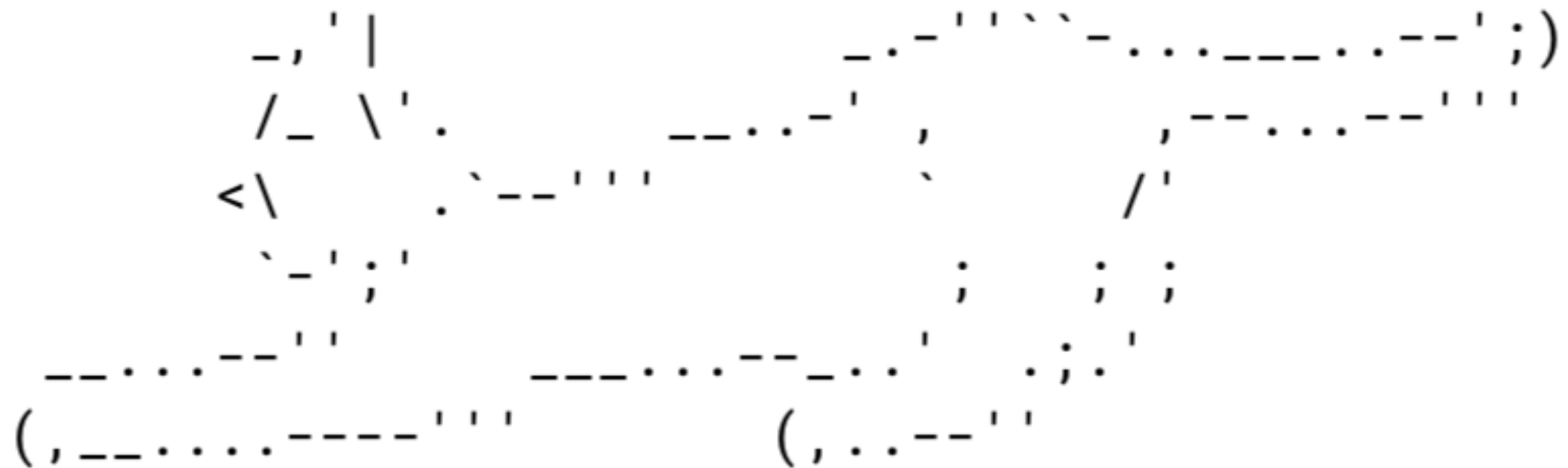
Quantum Consensus

- Goal: Quantum Cryptocurrency

- Team: Matthias Hudobnik, Anders Rehult, Takaaki Matsuo, Bram Dobbelaar, Wojciech Kozlowski, Marc Gaensler, Oleksandr Mykhalevych, Anton Karazeev, Takahiko Satoh

- Implemented: leader election algorithm using quantum

  - Coin Flipping Leader Election (arXiv:0910.4952v2)

  - W State Leader Election

- GitHub repo

IRTF draft

- "Advertising Entanglement Capabilities in Quantum Networks"

- Team "AdvEnt": Kireeti Kompella, Melchior Aelmans, Stephanie Wehner, Cristian Sirbu

- Will be submitted & discussed at Quantum Internet RG

  - https://www.irtf.org/mailman/listinfo/qirg

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QuViz

- Test suite to visualize the stability of a Quantum Network

- Team: Markus C Braun, Pedro da Silva Vaz, Sergio Freitas

QuViz tested networks

QuViz features

- updating network connection
- QBER determined color highlighted network information
- introduced latency between sender and receiver
- introduced T1 noise level

QuViz Future Work

- Introduce more parameter to categorize the stability of the network
- Expand the network by introducing other connections and more nodes
- stabilize the visualization part

Sim-NG

- Improvements to SimulaQron

- "Team": Amjd Yousef Majid, Daniel Quinn, Asbjørn Sloth Tønnesen, Michael "MC" Cardell Widerkrantz

- https://github.com/cgmcintyr/SimulaQron

Ipv6 support preparations
#92 by asbjornst was merged 23 hours ago

Fix repo (remove excutability, Vim swapfiles, add .gitignore to clib)
#91 by asbjornst was merged 2 days ago

Develop
#90 by Wojtek242 was merged 2 days ago

cqc: use big endian aka. network byte order
#89 by asbjornst was merged 2 days ago

Fix reference to right constant names of config/settings.ini in docum...
#88 by przemyslaw-pawelczak was merged 2 days ago

Add the 'cabler' script
#86 by danielquinn was merged 2 days ago

Clib fixes
#85 by asbjornst was merged 2 days ago

ProgressBar: detect terminal width
#84 by asbjornst was merged 3 days ago

Spec errors
#83 by AcksID was merged 3 days ago

pep8 issues
#82 by AcksID was merged 3 days ago

LICENSE: revoke executable permission
#81 by asbjornst was merged 3 days ago

Fix anomalies in the the CQC spec.
#80 by mchackorg was merged 3 days ago

Conform to pep8 (mostly)
#79 by danielquinn was merged 3 days ago

Qhamster

- Project: Qchat Improvements

- Team: Tudor Tabacel, Syed Affan, Matt Skrzypczyk

- Goal: decouple Client/Server functionality and provide a language independent client interface

- Results:

  - Organized services, Python XML-RPC Server, Interoperable web and cli XML-RPC clients, Backend improvements
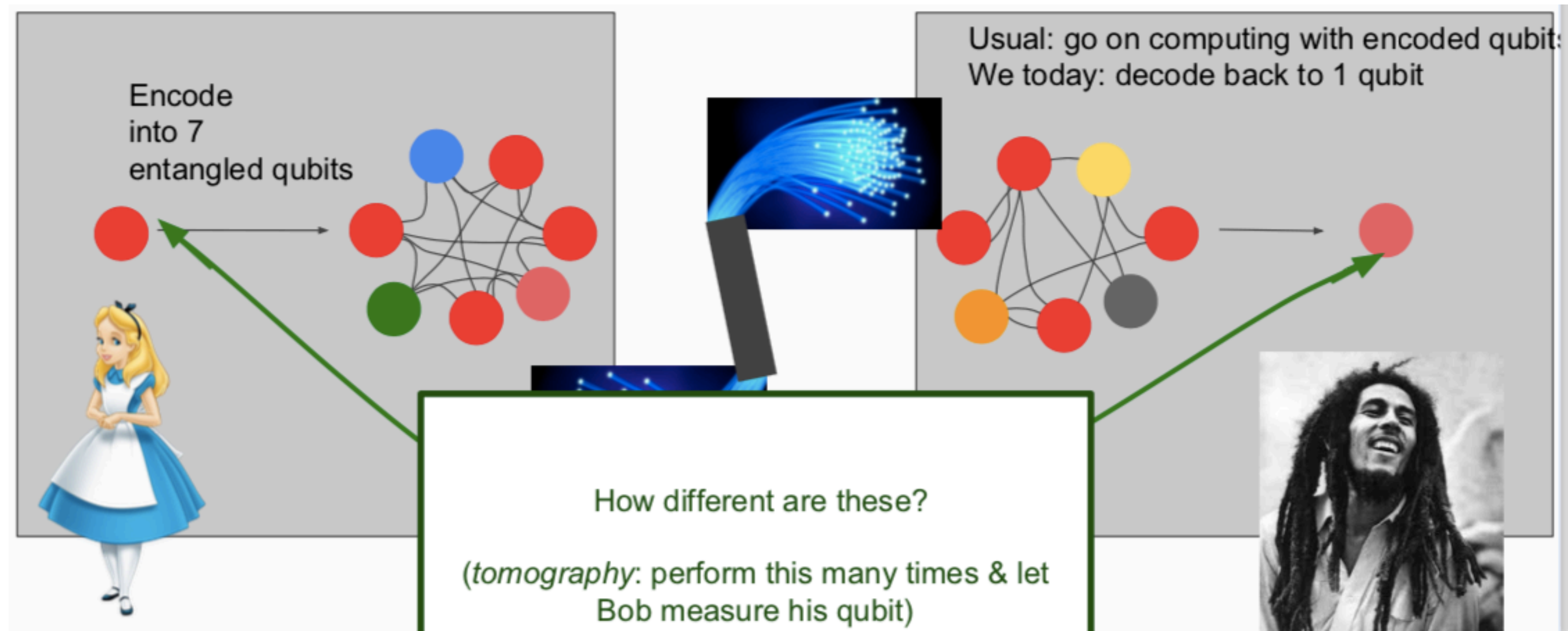
Quantum Digital Signature

- Team "Hanko": Shota Nagayama, Hirotaka Nakajima, Shinnosuke Ozawa

- Goal: design quantum digital signature "protocol" rather than "algorithm"

- Results: variable key length, variable msg length,
  simple stabilizer states quantum one-way function & a draft for the 2-party protocol

- https://github.com/ngym/quantum_digital_signature

"Steane on SimulaQron" (S.O.S.)

- Team: Tim Coopmans, Leon Wubben

- Project: Quantum Error Correction (Steane code)

Encode into 7 entangled qubits

Usual: go on computing with encoded qubit
We today: decode back to 1 qubit

How different are these?

(*tomography*: perform this many times & let Bob measure his qubit)

aMBiQuiCy

- Project: MBQC subroutine for SimulaQron

- Implementation: Blind Quantum Computation

- Team: Andrey, Anne, Cristopher, Georg, Marc, Shraddha, Yao

- <u>Demo</u>