

# Architectural Principles of a Quantum Internet

<https://datatracker.ietf.org/doc/draft-irtf-qirg-principles/>

## QIRG Virtual Interim 8 April 2020

Wojciech Kozlowski

Stephanie Wehner

Rodney Van Meter

Bruno Rijsman

Angela Sara Cacciapuoti

Marcello Caleffi

# Recap

- First version of draft prepared and presented at IETF 104 in Prague on 26 March 2019
- Main motivation is to address charter point:  
*An architectural framework delineating network node roles and definitions, to build a common vocabulary and serve as the first step toward a quantum network architecture.*
- Also want to create a good starting point for people with no quantum background

# Recap

- Draft was adopted by QIRG at IETF 104
- Discussions continued in 4 web calls in Sep/Oct/Nov and at IETF 106
- Following lots of feedback everything up to section 5 has been reworked
- More comprehensive and accessible now

# GitHub

- A GitHub repo is maintained at <https://github.com/Wojtek242/draft-irtf-qirg-principles>
- A more convenient way to share updates at a finer granularity than datatracker allows
- However, all discussions are still done on the mailing list so no fancy CI/CD

# Overview of changes (since 106)

- Two new authors: Angela Sara Cacciapuoti, Marcello Caleffi
- New section on elementary link generation
- Comparison with classical networking (MPLS)
- (WIP) Entanglement swapping vs classical forwarding
- Other minor updates and modifications

# Elementary Link Generation

- First step in generating end-to-end entangled pairs between is generating entangled pairs on each link (elementary links)
- At the physical level there are three methods for this: “mid-point”, “source”, “both ends”
- Understanding this is important to understanding how a quantum node “receives” an entangled pair

# Classical Network Comparison

- Thought experiment that outlines an MPLS-like approach to quantum networking
- This is not so much an architecture proposal as it is simply an analogy to help contrast quantum networking to classical networking
- Identifies various key components of a potential quantum network architecture

# Swapping vs Forwarding

- First generation of quantum networks will not forward quantum packets
- Entanglement swapping is different in many ways to forwarding
- For example, entangled pairs are not directed
- Currently WIP on GitHub (not present in latest draft version)



# Looking Forward

- I wanted to have more coverage of security, but there are no updates on this
- It is a complex topic that might not be suitable for a high-level document like this
- One option is to leave it as it is for now, add references, and, if needed, create new document in the future devoted to security

# Looking Forward

- Section 6: Goals and Principles
  - Upgraded to their own section
  - Trimmed down to be less opinionated
  - Needs community input – after a year of list activity I hope there are now more people able to contribute to discussion

# Looking Forward

- Add references (Rod suggested a bunch)
- A final editorial run-down once section 6 is finished – Rod's e-mail from 6 Mar 2020 with several comments will be a starting point

# Next Steps

- A side meeting to discuss section 6 was scheduled in Vancouver
- Virtual Interims currently limited to IETF 107 replacement meetings
- Will start discussion on mailing list instead

# Next Steps

- Once section 6 is complete, start a final revision using Rod's 6 March e-mail as starting point
- Aim to complete draft by IETF 108/109