Quantum routing approach for data networks: a solution for the congestion problem

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Silva Agustin, Zabaleta Omar, Arizmendi Constancio

agustinsilva447@gmail.com

Complex Systems and Quantum Computing Laboratory
Faculty of Engineering - National University of Mar del Plata

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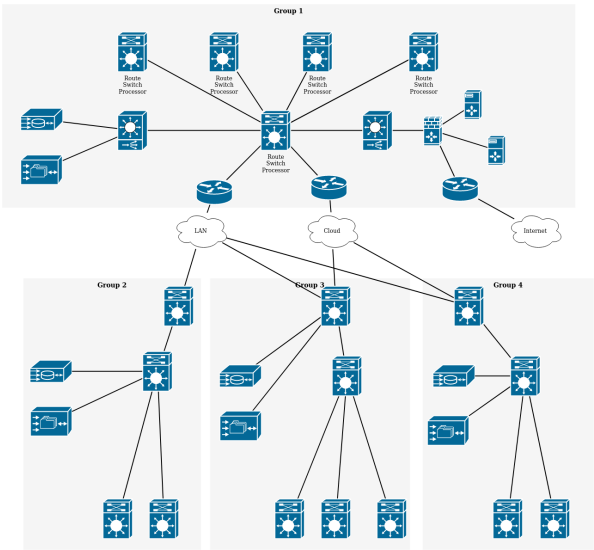
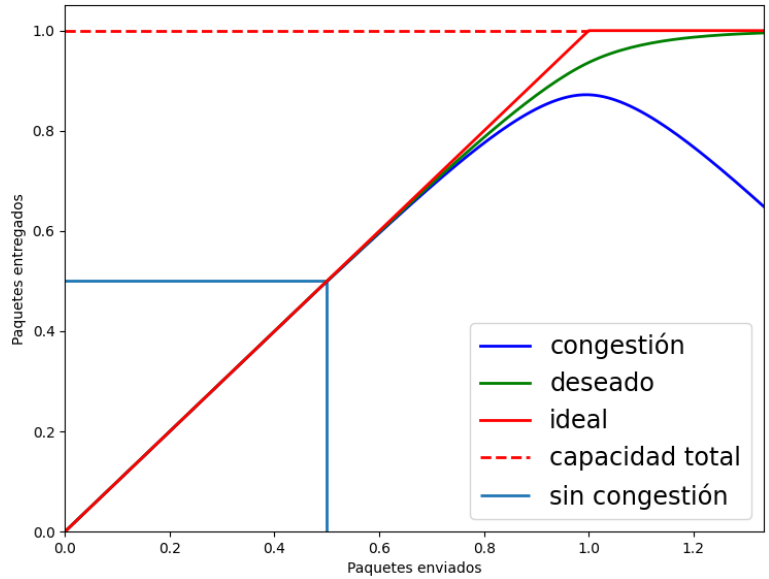
The Congestion Mitigation Problem

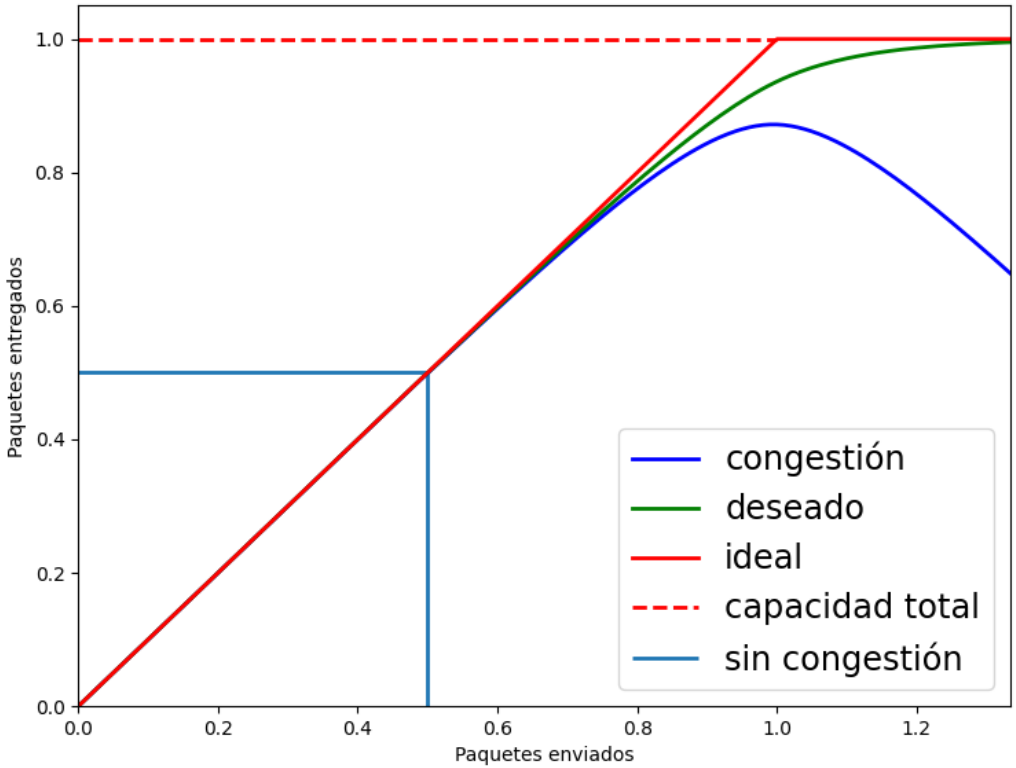
Communication systems networks

The most important problems to solve in modern wireless networks are energy consumption, data security and congestion mitigation. Congestion occurs when the number of packages is greater than the capacity of the network.





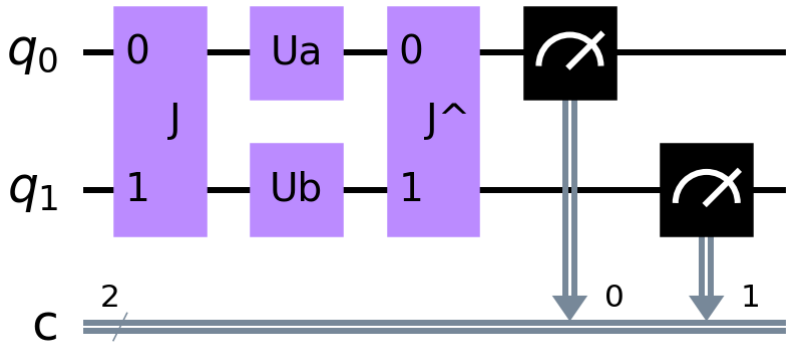
The Congestion Mitigation Problem



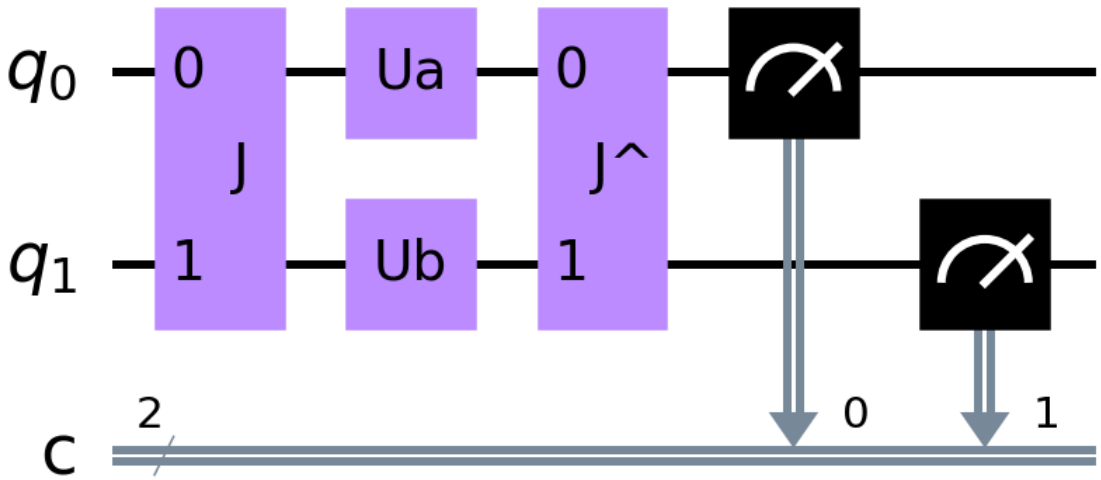
Quantum Game Theory (QGT)

Non-cooperative game theory (GT) is the mathematical basis for making optimal decisions in competitive situations. Any quantum system that can be manipulated by two or more parts is conceived as a Quantum Game.

		Bob	
		Cooperate	Defect
Alice	Cooperate	(3, 3)	(0, 5)
	Defect	(5, 0)	(1, 1)



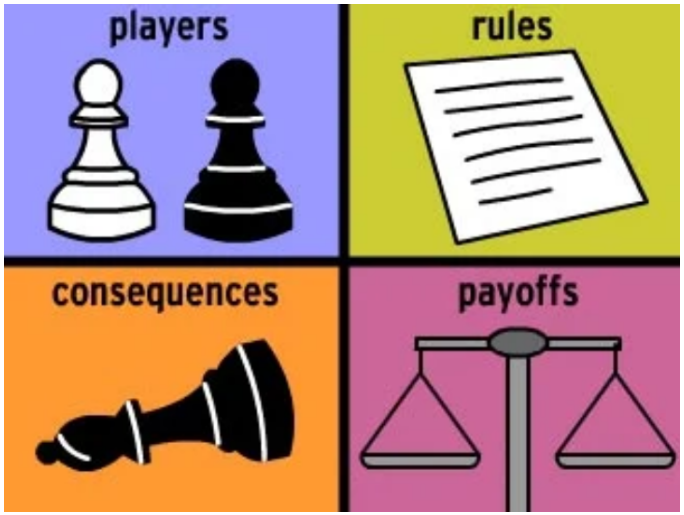
Quantum Game Theory

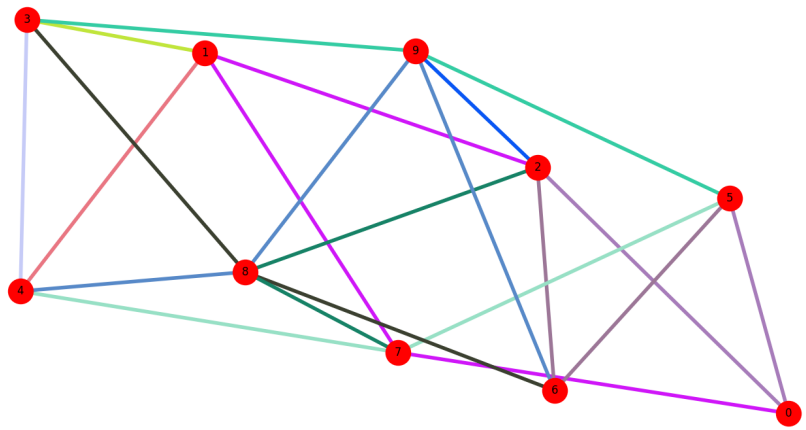


Protocol

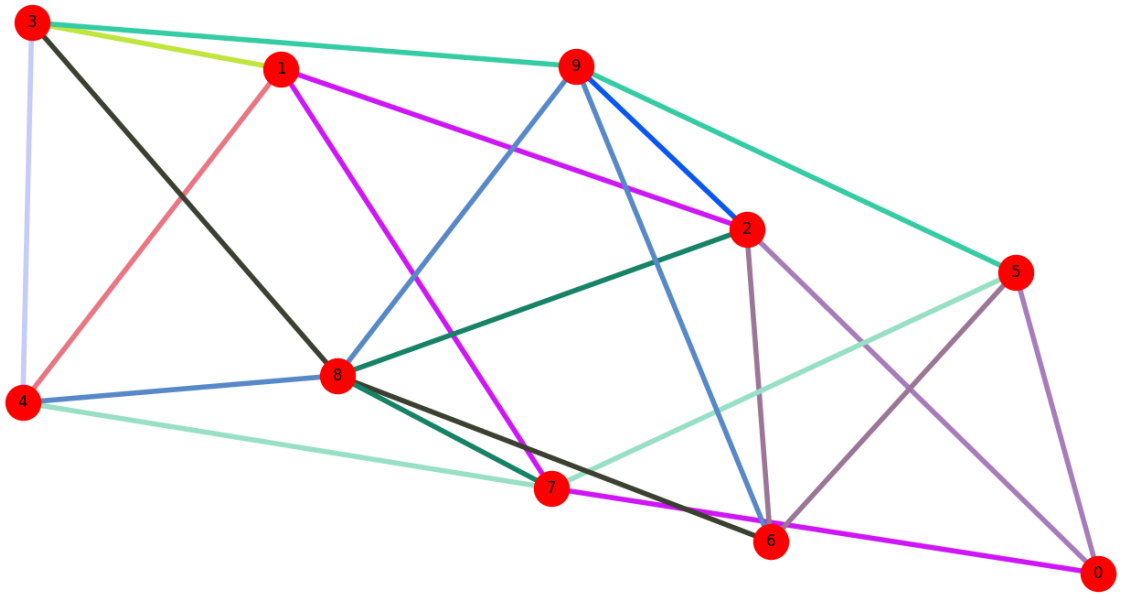
Let's play a game

One game will be played on each channel that wants to be used by two or more packages. Every player has two possible actions: use that channel or look for another one.





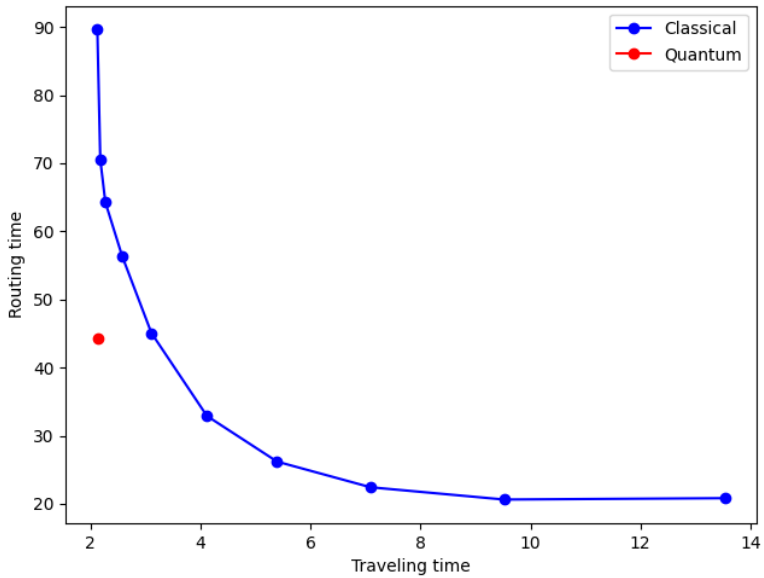
Protocol



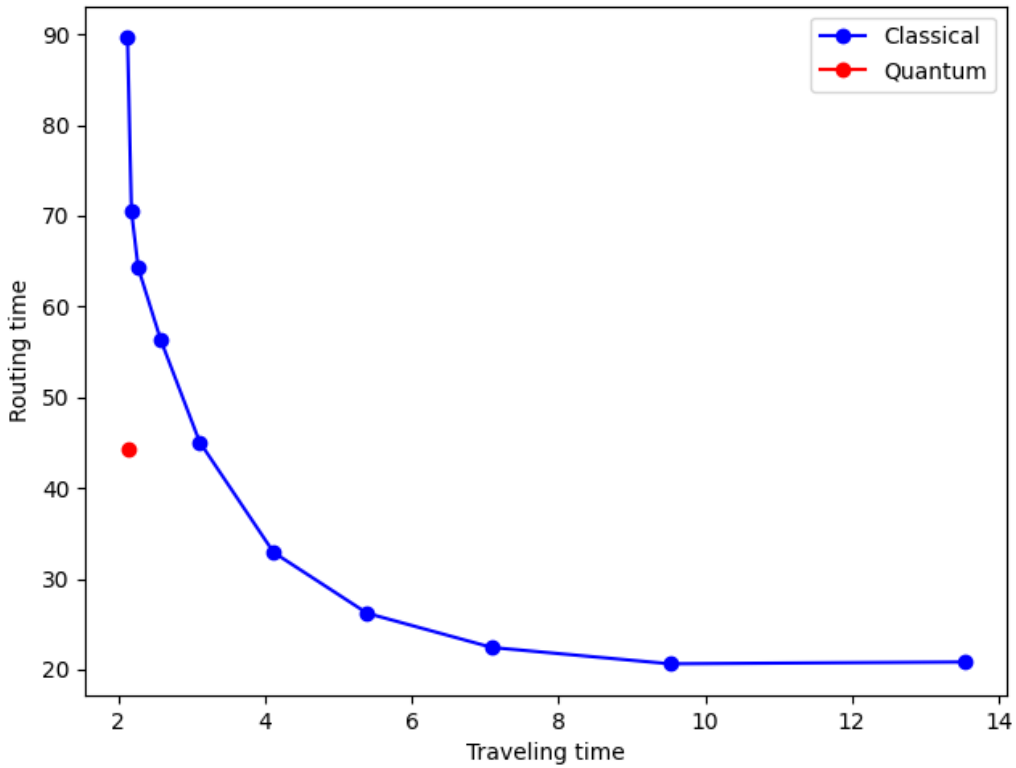
Results

The solution to the problem of congestion using classic protocols presents a trade-off between the routing time and the traveling time. However, by making use of quantum entanglement we can break the classical constraints to obtain a higher performance.

$$|\psi_{out}\rangle = \frac{|01\rangle + |10\rangle}{\sqrt{2}}$$



Results


Classical
Quantum
Routing time
Traveling time
90
80
70
60
50
40
30
20
2
4
6
8
10
12
14

Conclusions

- It is possible to apply Quantum Game Theory in complex communication systems.
- These results encourage us to develop complete protocols that can be scaled to real scenarios.
- The proposed quantum systems have a remarkably higher performance than their classical equivalent.

THANK YOU FOR YOUR ATTENTION!

Questions or suggestions to agustinsilva447@gmail.com