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TRUSTED NODE SATELLITE-QKD CONSTELLATIONS WITH INTER-SATELLITE LINKS

Abstract

A single trusted node QKD satellite in a polar orbit can allow secure keys to be shared between any two ground stations when the satellite flies over. Such flyover occasions for any specific location are limited however, particularly over equatorial regions. Cloud cover and daylight further constrain the opportunities when QKD can be performed. The nearest term implementation of a large scale global QKD network with many optical ground stations will therefore require constellations of QKD capable satellites. Based on work published by IQC we have developed Matlab models of free-space QKD links and we have combined these with the AGI STK software package to model satellite-to-ground and inter-satellite QKD for various constellation and ground station combinations. The satellites are modelled as trusted nodes with comparable specifications to the Chinese Micius satellite whose results were used to verify the Matlab model. The operational concept is that the satellites build up a buffer of secure key with every ground station they pass. At a later time, when two ground nodes wish to communicate securely, a symmetric key can be produced by performing an XOR on the buffered keys held within the satellites for the two ground nodes. These XOR keys are delivered classically via relay nodes in higher orbits (e.g. geostationary) to allow for secure communications with minimal latency. Inter-satellite QKD links are not required, but can be used to balance the stored keys between satellites and thus maximise the options available for XOR keys. Trade-offs of different constellation types, key usage patterns, and ground node arrangements will be discussed along with the latest satellite QKD developments from CQT and their spin out company SpeQtral.