Introduction to the quantum internet

The year is 1969. It is late at night and a group of people at the Stanford Research Institute are gathered around a monitor. Then the phone rings. The voice on the other side asks if they can see the letter L on the screen. “Yes, we see the L.” This is how the first message is how the first message was communicated over the classical internet. Only then it was called the ARPANET. It consisted of four nodes at different universities, and the first letter was send from UCLA. There they tried to send a second letter. “Can you see the O?”, they asked. The O is confirmed, but when they try to send the third letter, the system crashes.

So at this point in time it was extremely difficult to send messages over the internet. The internet was also extremely small, but as we all know – and it was probably hard to imagine this in 1969 - the internet is extremely large now. And in fact we could probably not imagine life anymore without the internet.

So here at QuTech, in 2020, we are aiming to have a small four node network which might become the first quantum internet on earth.

So the difference between a classical and a quantum internet, is that a quantum internet allows us to send qubits from one network node to the other. This allows us to create quantum entanglement between any to points on earth. And entanglement is actually pretty cool. It has two properties: it is inherently private, which enables secure communication, and it allows complete coordination. And this makes it extremely powerful for tasks like clock synchronisation.

What I really want to do, is I really want to send qubits from one place on earth to any other place on earth. I really think it would be super cool if we can generate entanglement between any two points on earth.

There is very many applications already known for such entanglement. It also would allow us, by the way, to give a completely new tool to study physics. So this is really my objective.

So a quantum internet is now at a very similar stage than a classical internet was in the 1960’s. It was successful not just because of a small group of technical people, but because of a very large community that thought about how we can use the internet to fundamentally change the way that we communicate today.