

## **Invention Title**

Using drones in operations to enable seamless network repairs

## **Invention Summary**

The idea is to use drones to help establish alternate network paths when the operations crew has to make physical repairs to plants, such as when they need to splice cables, change cable terminations, or anything that involves disruption to network cables that are in use by customers.

## **Invention Description**

Let's consider the simple case where a network cable or connection is either cut or disconnected, respectively. When this happens the network is disrupted, and any customers who were reliant on that network path experience degraded service (while network traffic is re-routed, if multiple paths exist) or their service stops. This invention is about eliminating, or at least minimizing, this disruption via the use of one or more drones.

Option 1: Wireless backhaul without session continuity, i.e., with some disruption

In this case the anticipated network disconnect is identified (e.g., via a network map) and an alternate path setup via a drone that connects existing endpoints, e.g., between nodes, or a node and a tap leading to the customer's home. These network points are outfitted with bridges that move the traffic over the wireless path provided by an access point on the drone.

There is no session continuity, and we rely on the applications (e.g., VoIP, video on demand) to retransmit to ensure session continuity. It also makes for a simpler design since this is as good as creating a new network path. This is useful for minimal implementation (additional network path) or when a network is already disconnected (e.g., a cut cable).

Option 2: Wireless backhaul w/ session continuity

This is similar to Option 1, except that session continuity is maintained. Specifically the alternate path is setup \*before\* the network is brought down. The sessions are also transferred over first without disrupting anything in progress. This would require a bridge, similar to Option 1, but one that coordinates with the network elements, such as routers, bridges and hubs - upstream and/or downstream - to maintain session continuity by transferring them over the alternate path. This can be accomplished by extending SDN capabilities to allow for session continuity.

Option 3: Wireless access to the homes that are affected, via macro-cell backhaul

For cases where alternate network paths are not cost effective, or cannot be easily accomplished, the drone can create a bridge between macro-cell backhaul (e.g., LTE, or a point to multi-point connection) and provide wireless (e.g., wi-fi) access to homes with wireless gateways. In this case, if the wireless gateway is provided by the operator, then the access point on the drone can either connect to the wireless gateway at home or extend the network to provide an easy alternate path.

## **Invention Commercial Value/Customers**

This would enable much better customer satisfaction since outages during crucial network cable repair is eliminated, or minimized.

It can also help minimize operational costs by allowing for repairs when required, rather than during "down times".

## **Invention Differences**

I am unaware of any current work in this area.