ONWARD TECHNOLOGIES llc

Aerostats As Wireless Infrastructure

There is a need for alternatives to modern high-speed Internet powered by fiber optics.

Fiber optics provide immense capacity, lightning speed, and low latency connectivity. It offers significant performance advantages over other competing telecommunication technologies such as 4G and 5G LTE cellular networks, high-speed coaxial cables, Digital Subscriber Lines, microwave links, and various satellite-based Internet access technologies. However, the cost of laying fiber can be prohibitive to undertaking required infrastructure build out in all but the richest countries. Countries such as China due to the rapid pace of industrialization and high population densities enjoy a manageable per capita cost for the buildout of fiber optics infrastructure. Even in some highly industrialized countries, a large portion of commercial buildings still do not have commercial grade high-speed fiber optics connectivity and as result have to rely on leasing wired circuits from their landlords, ILECs or CLECs at restrictively high monthly costs. In an urban environment the cost for trenching optical fiber can be excessive and municipal ordinances at times will prohibit it. In suburban and rural settings, the per mile trenching costs are lower, however the lower population density requires laying longer fiber runs often resulting in per capita infrastructure costs even higher than that for an urban buildout.

DS-3 and OC-3 are dedicated lines (or networks), and as such, they are guaranteed by their respective SLA clause to have a certain level of availability and latency, hence they are in demand from businesses requiring dedicated bandwidth for their operation adding to higher cost. Shared networks such as cellular networks, DSL lines, cables and satellite wireless networks, or shared fibers such as Google Fiber do not come with such guarantees and so offer services on a “best effort” basis with no service guarantee which are less costly to operate. Currently 4G/5G speeds are already on a par with dedicated DS-3 or OC-3 lines at roughly two orders of magnitude lower cost. However, they are entirely unsuited for mission critical operations. Shared network connections can be dropped for no apparent reason, and their generally low availability means a certain fraction of their data packets will be dropped and automatically resent via automatic repeat request (ARQ) and may cause random delays in the transport of data, which translates to increases in transmission latency.

A further thought on the upcoming 5G expansion. Presently the thinking is to beef the hell up the large towers by super-fast fiber back-haul and to rely on higher frequency FR2 bands to back-haul the expected large increase in micro-cell, pico-cell and femto-cell miniature base stations with cell ranges as small as 20 m – 200 m. The wide use of such tiny cell sites can greatly multiply the frequency reuse by as much as 10–100 fold. Increasing the deployment of such miniature cells would strain the fiber back-haul for the taller cell towers tremendously. FR2 must rely on those dwarf cell sites to exist since high band mm waves have limited range, hence a cell site which has a radius greater than the range of the high band signals clearly does not work. Now imagine a tall tower is flanked by those dwarf cell sites which could easily number in the

100s, to feed those dwarf cells, an equal number of spot beams would need to be used since feeding so many cells in less than a square km with high-speed optical fiber would be unimaginably expensive. The trouble with feeding 100 small cells from a single tall (30m – 50m) cell tower is that it would be extremely difficult or perhaps impossible to avoid cross interference of those feeder beams, not to mention that it would be near impossible to house 100 high gain feeder antennas on a single mast. To minimize mutual interference, the feeder antennas all have to be pointed in different directions, however, since the area covered by the aggregate is likely to exceed a few square km, unless the tower is more than 150 m in height, the majority of the feeder beams travel almost horizontally, which makes it virtually impossible to avoid mutual interference.

Onward Technologies' Patented Alternative To Terrestrial Infrastructure

An aerostat is a lighter-than-air aircraft that is tethered to the ground and gains its lift through use of buoyant gas. Aerostats have been successfully deployed for military, security and surveillance applications for decades. More recently they are increasingly envisioned as wireless telecommunications infrastructure. The challenge to such use is the customer demand for service availability of 99.99%. Historically aerostats need be brought to ground every seven to thirty days to replenish loss of helium, in response to disruptive wind and weather or both which can dramatically limit services. Onward has designed and patented aerostat operational enhancement systems and absent Onward's systems it is not possible for an aerostat based telecom payload to provide a meaningful and reliable level of service availability.

Onward's patented and patent pending systems will enable its telecommunications infrastructure platform to remain on station for up to six months and is only brought down for regularly scheduled upgrade and/or maintenance or in the event of weather with winds approaching hurricane force. Onward's strategic operational advantage will enable its systems to operate as an independent network, a network extender of incumbent service providers and even as last mile connection for satellite constellations such as StarLink enabling it and competitive programs to access the promise of 5G. The future of telecommunications is wireless.

Onward Telecommunications is the infrastructure for the future.