

SPACE

At the highest level, from heights of 600-1500km are the satellite projects. Despite the recent loss of a satellite in an accident, Facebook, SpaceX, Samsung and Google are all investigating or actively working towards launching satellites that could provide mobile communications connectivity. SpaceX, supported by Elon Musk with Google and Fidelity, has said it wants to launch 4000 satellites up to 600km altitude between 2022 and 2030. OneWeb, supported by Richard Branson (with Virgin, Qualcomm, Airbus, the Indian Bharti Entreprises, Hughes Network, Intelsat and Coca-Cola), wants to deploy, before 2019, 648 satellites at 1200 km altitude by leveraging LTE, 3G and WIFI technologies. Samsung is designing a constellation of 4600 satellites 1500km from Earth using 5G networks.



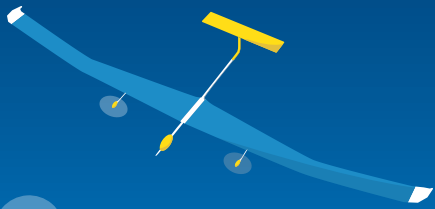
BALLOONS

Google Loon is a project based on balloons launched between 10km and 60km from Earth with lifespans of 100-150 days. High speed internet is transmitted up to the nearest balloon from the ground, relayed across the balloon network, and then back down to users on the ground. Google claims it has demonstrated data transmission between balloons over 100 km apart in the stratosphere and back down to people on the ground with connection speeds of up to 10 Mbps, directly to their LTE phones.



HIGH ALTITUDE PLANES

Up at 60-70,000 feet, how about Unmanned Aerial Vehicles (UAVs) transmitting data and video down to cellular base stations on the ground. One company, Roke Manor Research has said it is designing a system designed to give the ability for unmanned craft, such as the Airbus Zephyr, to communicate with a base station up to 50km away. Roke says it anticipates using beam forming technology of its own design to beef up the capabilities of standard 3G hardware. The adaptive beam forming will intelligently direct signal to a specific point on the ground — which could be commercial cellular infrastructure, or to a dedicated military base station. Facebook is also operating at this altitude, with its Aquila project that is designed to use solar-powered UAVs equipped with lasers to deliver data to any specific location within a 60 mile area on the ground. “Eventually, our goal is to have a fleet of Aquilas flying together at 60,000 feet, communicating with each other with lasers and staying aloft for months at a time.”



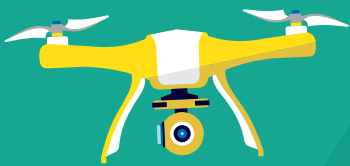
COMMERCIAL AVIATION

Taking the idea of flying cell sites one stage further is a company called Airborne Wireless Networks. This company wants to use commercial aircraft as mobile base stations — essentially as mini satellites — connected to each other in a meshed network, as well as to mobile entities on the earth’s surface (ships). Although AWN’s core patent is nearly 20 years old, it has just signed agreement to give it access to its first three commercial jets for a pilot of its system.



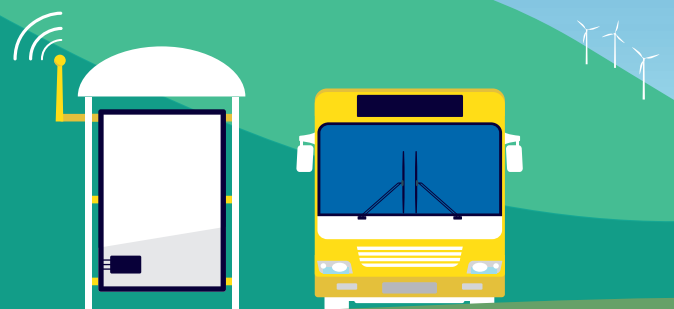
DRONES

Could you put a base station in a drone, and fly the drone to where you need coverage, say for an emergency or some other location that just needs more capacity at a given time? Why, yes you could. Several operators and vendors are exploring doing just that — including AT&T which even has a name for the concept — Flying COWS (Cell On Wings). Google is also reported to be investigating drone cells, in a project known as Google Skybender. And Ericsson and China Mobile have said they are looking at the potential as part of their 5G research. They reckon you need an edge core network as well, to reduce latency, and they also warn that safety will be paramount. After all, as they say, “Nobody wants to go out every day equipped with a helmet fearing for drones falling from the sky”!



STREET LEVEL

Getting small cells onto street level is about deploying in an unobtrusive way, where power and backhaul is likely to be available, Vodafone has been experimenting with bus stops and advertising signs that have built-in small cells. Outdoor ad “inventory” owner JC Decaux provides the ad signs and bus stops, while the likes of Huawei and Nokia Networks have integrated their small cells into the design. So far, Vodafone has trialled the system in the Netherlands.



UNDERGROUND

Ericsson and antenna company Kathrein have developed an underground cell site that puts the radio under a manhole cover, and then connects that via a cable in an existing duct to a specialised antenna that sits in the road or pavement. The antenna comes with a special hard-wearing lid of its own so can withstand traffic of the non-mobile variety. Literally building a network from the ground up. Swisscom has piloted the tech in public trials in Bern.

