What if internet by satellite were to lead to congestion in orbit?

Internet satellite companies, such as Starlink, OneWeb and Blue Origin (Amazon), aim at providing global internet access via satellites. This will bring many benefits to citizens, isolated regions and the global economy, but what if internet satellites collide with other satellites? What if an internet satellite company becomes the next internet monopoly? What if satellite debris hits people on the ground?

Throughout history, humans have developed ways of communicating and transferring knowledge over long distances, from transmitting public information via smoke signals and sending private messages via homing pigeons to developing modern telecommunication technologies, with the internet at the top of the list.

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The internet is a global network of interconnected computers that communicate with each other by sending and receiving signals. Although the military used the internet as early as the 1960s (ARPANET), it took until the 1990s to commercialise the network for the public. The internet is provided at local level by different organisations that serve limited geographical areas either via wire (fibre optic, digital subscriber line (DSL)) or wireless connections. The organisations that connect end-users to the internet are known as internet service providers (ISPs).

Starlink aims at providing worldwide high-speed internet access via thousands of satellites. The project is run by an American aerospace company, SpaceX, which plans to serve North America by 2020 and the rest of the globe by 2021. In October 2019, paperwork for an additional 30 000 satellites was filed, on top of 12 000 that have already been approved by the United States Federal Communications Commission (FCC). Once approved, the FCC will submit these filings to the International Telecommunication Union (ITU), the United Nations agency that coordinates telecommunications at international level. Although launching a great number of satellites was hitherto considered an expensive option, SpaceX benefits from its relatively cheap launchers due to its success in developing reusable rockets. The revenue from Starlink will be invested in SpaceX and CEO Elon Musk's goal of colonising Mars. Europe has long been interested in Mars exploration, and the European Union supports missions to Mars via the European Space Agency (Aurora and ExoMars).

Potential impacts and developments

With the explosive spread of digital transformation, the internet has become a vital element of human life, from contacting people and shopping online to controlling internet-connected devices. Nevertheless, half of the world's population still has no internet access, and many areas in the world, including oceans and remote islands, are not easily accessible. Global internet access would therefore not only connect isolated regions of the planet to the internet but also provide dense cities with high-speed internet of low latency (the delay between sending a signal and receiving a response). This would have a positive impact in various sectors, including the following examples.

- Every internet of things (IoT) device needs the internet to communicate. For example, medical devices could access the internet to contact an ambulance, and self-driving cars could access the internet to pick the best route.
- Rural areas, which historically suffer from a lack of services, could accelerate their development. Moreover, children in these areas would have access to online education.

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- In the ocean, fishermen and sailors could access the internet easily, and the availability of the internet would help in ocean governance.
- Internet coverage in farming would allow for more information transfer, and increase capabilities for planting, harvesting and other activities in the food cycle.
- Global internet access would open new markets for internet technologies, as well as boost the creative industries. It is worth mentioning that internet satellites could be a cheaper solution for 5G deployment than replacing ground infrastructure. For example, it is estimated that shifting to 5G in the USA using fibre optics will cost US$130–150 billion, whereas the entire Starlink project will only cost around US$10 billion.

Some technical risks arise from the life cycle of satellites and the nature of satellite communications. Signals transferred in an open medium (air or space) are easier to interrupt and could be collected by unintended receivers, although decrypting the signal would have to take place before accessing useful information. At the end of its life, an internet satellite turns into uncontrolled space debris that contaminates space and can potentially cause collisions. While there are projects that aim at removing debris from space, such as RemoveDEBRIS and ESA ADR, Starlink satellites are designed to avoid contamination of space by burning up in Earth's atmosphere, which results, however, in fragments that could reach the ground. In addition, astronomers are concerned that the growing number of satellites obscures their view of the Universe.

Since covering the globe with internet via satellites implies no escape from exposure to electromagnetic waves, there are concerns about the health impacts of the radiation. Although the relation between cancer and telecommunication waves is controversial, it is agreed that the risks depend on the type of wave and the intensity of radiation. International standards, set by the International Commission on Non-Ionizing Radiation Protection (ICNIRP), define radiation exposure limits. The EU rules on electromagnetic fields are laid down in Council Recommendation 1999/519/EC, based on the ICNIRP guidelines.

Data has grown exponentially in recent years, and globalising internet connectivity would boost the already tremendous growth of data. However, storing massive amounts of data comes at a cost: it consumes energy, much of which contributes to carbon emissions. Moreover, the machine-learning industry is hungry to develop what can be sold as artificial intelligence by mining these data using intensive computing power.

Having thousands of satellites in space would intersect with European space projects and would require coordination of satellites in order to avoid collisions between European and internet satellites. In September 2019, the European Space Agency performed an evasive manoeuvre to avoid a potential collision with SpaceX, demonstrating an urgent need for space traffic management with more intelligent control.

As internet infrastructure (cell towers or fibre optic cables) is expensive to build, it is not easy to break the monopoly of the current players in the market. If successful, internet satellites would break the present ISP monopoly, but might perhaps replace it with another monopoly. A global internet satellite service would also weaken the potential for internet censorship compared to the present situation, where local authorities control internet access by blocking websites or even shutting down the internet via national ISPs.

Anticipatory policy-making

As internet satellites are not deployed in air space, but in outer space, which according to international law, is free for use by all states and thus not subject to a claim of sovereignty. However, international space law enforces liability for any damage caused by space objects and obliges states to avoid harmful contamination.

It is advisable that future EU space policy consider the swift development of internet satellites. It is vital that EU legislation is reviewed with an eye on the potential risks such as the health impacts, the internet monopoly, signal disturbances by destructive interference, and the consequences of satellite debris. Some of these issues (i.e. signal disturbances and satellite debris) were addressed in the Commission's proposal for the Space Programme in 2018. A critical issue is the balance between the risks and gains, especially the trade-off between the security of the European Union and catching up with competitive technological advances. The security aspects include ensuring the robustness of communications and the ISPs' compliance with the EU's General Data Protection Regulation (GDPR). Additionally, handling soft impacts is also needed, perhaps by pushing ICT industries towards cleaner energy.