Your response

Your response should include details of:

- a description of the relevant technology;

- a view of the potential impact of the technology on the sectors we regulate, preferably

- identifying the impact against the criteria listed in section 3.16 of the call for inputs;

- the current state of development of the technology, including any demonstrations of

- feasibility;

- any unresolved issues which need to be addressed for the technology to achieve full

- potential;

- references to key publications and the leading groups working on the technology; and

- whether you would be open to discussing the technology in more detail with Ofcom.

Your response
Confidential? – N ## Description Cloud computing has grown rapidly worldwide as companies and governments invest in digitising operations, new technologies, and developing infrastructures to create unmatched agility and efficiency in business operations. Forbes has predicted that, as most enterprises use cloud today, **83% of enterprise workloads would be in the cloud by the end of 2020**. With cloud applications becoming more mission critical to enterprise operations, secure, reliable, and resilient networks will be needed. Network operators need to prioritise application awareness and flexible allocation of bandwidth from end-to-end to support the delivery of reliable, high-performance cloud services. Organisations are also seeking services to manage multi-cloud environments, cloud interconnect, and network convergence as cloud services mature in the region. The demand for these services has increased in all markets where adoption is still low, and in parallel, there has been an urgent need for remote working due to the COVID-19 pandemic. 5G (as a network of networks) and other next generation applications are also driving network performance demands in industries such as mining, energy, and financial services where connectivity to operations in underserved areas was previously impossible. Governments and companies with remote, offshore or rural operations typically need a reliable and secure way to enable employees at home and in remote facilities to access internal systems through the cloud, send and receive large volumes of real-time data across geographical areas, and ensure business continuity. Challenges to creating a cloud-optimised ecosystem, such as addressing high bandwidth requirements and reducing latency issues that slow real-time processes and workloads, plague organisations with dispersed operations. As cloud and edge service demands grow, satellite connectivity can newly help organisations with geographically dispersed operations and workforces to maximise productivity and scale operations as needed well into the future. **Satellite intelligent networks can deliver the unmatched reach and instant, secure, resilient connectivity to the cloud that customers require to run modern,**

future-ready operations. For example, SES offers an ideal combination of coverage, throughput, and low latency performance thanks to its unique combination of GEO and MEO HTS assets, with more than 70 satellites in operation, including the existing O3b constellation. SES is also to add flexibility, scalability and efficiency with a new generation of Medium Earth Orbit (MEO) satellites called O3b mPOWER to ensure that facilities and people at work or at home everywhere can quickly, securely and efficiently access cloud data centres.

There are five reasons to consider satellite-based cloud connectivity:

1. to connect mobile data centre solutions,
2. to connect remote locations where terrestrial networks are unavailable,
3. as a backup to ensure business continuity when terrestrial connections fail,
4. to quickly connect locations that have a long lead time for fibre, and
5. to enable innovative services with reduced remote hardware footprint.

If cloud connectivity becomes ubiquitous across an entire organisation, regardless of where it operates, the benefits of the cloud increase, and the organisation becomes more cost efficient and productive. The virtualisation of satellite communications network functions combined with new forms of dedicated usage of radio spectrum makes it possible as never before.

Impact

- *Enable the delivery of **new services** which are valued highly by people and businesses*

  Satellite facilitates the deployment of new applications based on 5G, the Internet of Things (IoT) and artificial intelligence (AI) to access cloud resources anywhere, anytime across the globe.

- *Broaden and deepen **access to services***

  Satellite contributes to:
  ✓ Providing reliable and secure way to employees at home and in remote facilities to access their organisations' internal systems through the cloud, send and receive large volumes of real-time data across geographical areas, and ensure business continuity including at home during pandemics (e.g. COVID-19), whether in urban or rural areas, but also off-shore or on board moving platforms (cars, trains, ships, flights)
  ✓ Enlarging and accelerating the delivery of video content to broadcast and VOD platforms worldwide, relying on the most performing and reliable transfer technologies, whether for IBM Cloud (https://www.ibm.com/case-studies/ses-platform-services) or MS Azure Cloud (https://azure.microsoft.com/en-us/blog/azure-media-services-new-ai-powered-innovation/)
  ✓ improving connectivity performances by direct access to the cloud, through a private, dedicated connection of up to 2 Gbps, or by remote access by VPN through the public cloud of up to 500 Mbps, all orchestrated by end to end managed satellite services to the customer

- *Increase the **performance of networks**, improving the experience for people*

  SES satellite network is getting designed to allow users to dynamically allocate low-latency, high-bandwidth service anywhere, which is the type of consumption-based cloud model government and enterprise customers are seeking today. This is made possible thanks to:

- ✓ Launch of terabit-level, highly flexible and scalable O3b mPOWER satellite communications platform in 2021 (https://www.ses.com/networks/networks-and-platforms/o3b-mpower)
- ✓ Adoption and implementation of ARC functionality: the role of the software system Adaptive Resource Control (ARC) is to manage resources to follow customer demand, synchronise satellite spacecraft and ground system resources, dynamically controlling power levels, throughput, and frequency allocation to reliably meet robust service level agreements (https://o3bmpower.ses.com/software-systems). ARC will enable the dynamic control and optimisation of power, throughput, beams and also frequency allocation across the entire O3b mPOWER system's space and ground assets. ARC's dynamic frequency allocation capability can also be leveraged to mitigate interference, provided adequate timely and accurate information is available
- ✓ Adoption and implementation of open, standards-based network automation and service orchestration solution built on Open Network Automation Platform (ONAP), to quickly create, deploy, and automate the end-to-end delivery of services across both physical and virtual networks. ARC manages the physical network resources allocated to services orchestrated end-to-end by ONAP
- ✓ Extension of network services and activation of virtualised network functions (VNFs), such as security, WAN optimisation, and SD-WAN quickly, and at scale, to accelerate customers' time to market and improve service agility. By separating key networking functions from purpose-built network hardware, SD-WAN (Software Defined Wide Area Networking) notably leads to manage and automate the provisioning of access connections via terrestrial and mobile broadband but also via satellite at distance and in real time, in a way that dramatically improves communications network resiliency and service availability(https://www.ses.com/sites/default/files/2020-02/SD-WAN_Insight-Paper_Fixed-data.pdf)

- **_Lower barriers to entry_** _for providers, enabling choice for people_

   Relying on a network automation and orchestration service that provides private, dedicated access to a cloud via satellite across the world, all governmental and enterprise users of e.g. MS Azure can manage their workloads entirely in the cloud via a secure connection. Any MS customer can also opt into a service level agreement to guarantee that they always have the connectivity they need to manage their workloads in the cloud—accelerating their time to market and enabling them to scale their operations whenever they need to.
   Our soon to be launched O3b mPOWER satellite platform inherently supports the consumption-based cloud model, because it's designed to allow users to dynamically allocate low-latency, high-bandwidth service anywhere. The system is also designed to fully integrate with existing network solutions and adapt to evolving technology.

- **_Reduce the cost_** _of delivering services, increasing access and maximising value for customers_

   O3b mPOWER can lower the total cost of ownership for customers, reducing cost-per-bit as their capacity requirements increase. A new generation of customer terminals in a range of sizes and form factors also provide savings. By reducing the size and mobility of the antennas, we are making it easier for our customers to install them when and where they are needed, while focusing on total cost of ownership.
   The ability to activate additional capacity in a completely dynamic way, as and when needed, also grants customers the flexibility to offer extra services for limited periods of time, rather

than having to order a more expensive, fixed bandwidth package based solely on peak demand.

- *Change the way Ofcom **authorise and regulate** networks and /services*

   The UK is the country responsible for the filing of our O3b satellites to the ITU. SES relies on UK Ofcom's best and most practical approach to manage our existing and future filings.

   SES would also welcome Ofcom's support for the CEPT to adopt harmonized regulatory frameworks that are applying to MEO satellite services in Europe.

   SES finally counts on Ofcom's help to address and promote WRC-23 agenda items of key importance for MEO satellite services.

   SES would welcome to discuss these in more details with Ofcom.

- ***Reduce the total environmental impact*** *of delivery of communication services and associated activities*

   It is possible that the virtualization of communications network functions with the advent of SD-WAN and the generalization of cloud edge services will contribute to a reduction of the carbon footprint overall. In particular, newly designed satellite earth stations will act as intelligent units of hardware and processors which functionalities and maintenance can be managed and automated remotely and instantly with AI support, relying on software toolboxes. Such an approach will drastically limit the need for satellite engineers to travel to various remote sites or send hardware components via traditional transport means. SES has thus partnered with manufacturer Isotropic to this end. (https://www.isotropicsystems.com/news-3/2020/3/5/ses-and-isotropic-systems-enter-new-phase-of-customer-edge-terminal-antenna-development-to-unleash-o3b-mpower)

- ***Assure the security and resilience*** *of service delivery*

   As the only satellite-enabled telecommunications service provider with a multi-orbit, multi-band fleet, SES can address a much larger range of connectivity use cases than other satellite providers. One novel use case is intelligent network resilience, where, for example, GEO satellite links can back up a primary high-capacity MEO connection. The next satellite generation O3b mPOWER will allow it to be fully automated. This can form part of the solution for links where high availability ('four nines') is a requirement.
   By applying SD-WAN to multi-access networks using satellite links, SES also improves its network security: this is recognized as one of the strongest drivers for the adoption of SD-WAN (Futuriom, March 2019).[1] Rather than requiring a number of specialised appliances, SD-WAN leverages universal customer equipment and virtualised software instances to simplify and reduce the cost of security operations, deploying integrated stateful and next-generation firewall, malware protection, URL and content filtering, intrusion-protection services (IPS) and anti-virus, DDoS (Distributed Denial of Service) protection, and next-generation VPN.
   SES has to comply with the expectation of government customers who are amongst the most demanding users in terms of security and protection against detection an interception of communications.

---

[1] *See* https://www.futuriom.com/articles/news/sd-wan-growth-is-accelerating-in-2019/2019/06

Current state of development

- ✓ SES satellite network under continuous progress towards software-based virtualization
- ✓ SES existing GEO+MEO solutions already adopted by IBM Cloud for its Direct Link Service and by MS Azure for its ExpressRoute
- ✓ First batches of O3b mPOWER satellites to be launched in 2021-2022

Unresolved issues

SES is a strong believer in connectivity solutions that integrate terrestrial and satellite technologies. It's indeed been widely recognized that 5G (and 6G) communications will need to rely on such a mix of technologies.

For instance, as the only satellite-enabled service provider with certification from MEF (Metro Ethernet Forum), our new satellite network functions can interoperate with telecom and mobile network operators and cloud service providers with the same Layer 2 interconnection and industry-standard service level agreements used industry-wide. This makes integration with O3b mPOWER seamless, predictable, and efficient.

Our system is therefore designed to fully integrate with existing network solutions and adapt to evolving technology. In the future, we're confident that hybrid networking combining satellite and terrestrial services will play a bigger role in providing users with the additional network availability they need to manage larger, critical workloads in the cloud.

For this reason, SES would welcome any political or regulatory support to deepen our collaboration with the fibre or terrestrial wireless industries, as sometimes the importance of a mix of technologies in the future communications ecosystem is underestimated.

Publications and WGs

https://www.ses.com/networks/cloud
https://www.ses.com/future-proofing-cloud-scale-operations
https://www.ses.com/press-release/ses-enhance-and-expand-o3b-mpower-system-capabilities-dynamic-software-innovation
https://www.ses.com/blog/o3b-mpower-cloud-based-partnerships
https://www.ses.com/cloud-location-real-time

Discussion with Ofcom

Our SES teams would welcome having a thorough discussion with UK Ofcom about our cloud connectivity solutions and address policy and regulatory issues accordingly.