Space is a crowded place, some say, and the closer you look from Earth the more crowded it might appear.

A cluster of more than 1,000 satellites orbits at several hundred kilometres above Earth’s surface in the so-called Low Earth Orbit (LEO). They serve the weather and earth observation tasks, and fulfil multiple purposes, from private and civil to research and military applications. The International Space Station (ISS) – close to 400 kilometres – and the Hubble telescope – our eye into deep space at 559 kilometres – are amongst these LEOs.

There are thousands and thousands of kilometres to go through before encountering the Medium Earth Orbit (MEO), at 8,000 kilometres. Beyond that, the next sign of civilisation is far above, at 36,000 kilometres: the Geostationary Orbit (GEO), the second-most populated orbit after LEO. At GEO, there are over 400 large satellites in operation, travelling around the Earth at a speed of about three kilometres per second and thus appearing to be stationary from the Earth.

SES and O3b Networks offer an essential advantage to customers with a complementary satellite constellation.
The beauty of a GEO satellite lies in its ability to provide coverage over one third of the Earth’s surface and to cost-effectively connect people and places. The success of SES is based on this. Providing coverage for entire continents and countries, SES’s GEO satellites are perfect for broadcasting high-quality linear TV to millions of households, in HD and Ultra HD. From distributing live opera or pop music events to delivering breaking news or important global sporting events, GEO satellites such as the SES fleet are the ideal infrastructure to deliver content at an optimal cost.

Broadband connectivity via GEO satellites empowers communities in less-developed parts of the world, opening up new doors of knowledge that lead to economic development. They link multiple corporate sites worldwide, allowing thousands of employees working in remote offices to remain connected via broadband access and Voice over IP. They also, for example, connect oil and gas terminals, enable real-time monitoring of maritime wind-farms, and securely link banking terminals.

GEO satellites are further enhanced by an innovative satellite technology called High Throughput Satellite (HTS). This concept sees a concentration of satellite power onto smaller, focused beams so that the satellite can increase power levels and data throughput. Since the same spectrum can be reused in beams that do not overlap, the amount of capacity that the satellite can carry increases significantly, hence improving the pricing for the capacity.

Satellite signals travel at the speed of light. A signal from a GEO satellite would therefore take a quarter of a second for an up- and downlink – and twice as much for a two-way interactive exchange. This is a fraction of a second – a fraction, nevertheless. For large-scale TV coverage, this tiny delay is irrelevant. GEO satellites therefore offer powerful downstream connectivity for video and data transmission.

For time-sensitive applications, however, such as trading and banking, virtual desktops and medical imaging, where real-time or close to real-time transmission is crucial, this latency can affect applications’ functionality. In these cases, satellite also has to be as fast as fibre. Fibre in the sky.
O3b Networks: A star is born

This is where the third orbit comes into play: the MEO. Less than one quarter the altitude of the GEO orbit, MEO reduces round trip latency from 250 to 60 milliseconds and thus delivers similar performance to fibre.

The terrific idea came to fruition in the autumn of 2007 when O3b Networks was founded. A unique new venture to offer high-speed connectivity from space: O3b’s high throughput of up to 1.6 Gbps per transponder and low latency delivers fibre-like broadband to a wide range of customers and industries, ranging from ISPs, telcos and enterprises to government customers, in the emerging markets of the world. O3b operates a constellation of 12 mid-size satellites today, manufactured by Thales Alenia Space.

At its lower orbit, the O3b constellation moves faster than the Earth’s rotation. MEO satellites are therefore not stationary to our eye and reception devices on Earth. Rising in the west, they pass overhead to disappear over the eastern horizon in a 360-minute cycle. Antennas on the ground track O3b satellites and hand over communications seamlessly from one satellite to the next.

Lower latency means that bits transit the system quickly, therefore supporting business applications that are latency sensitive. The close proximity to Earth also allows O3b to concentrate more power on its small beams. These beams can be easily repointed to cover new areas, hence offering flexibility to the markets.

The roaring success of O3b proves that the MEO satellites are driving a new era of connectivity. O3b already serves over 40 customers and has recently closed deals with some of the world’s largest telcos. It has quickly become the largest operator in the Pacific Islands and has enabled eight mobile network operators to launch 3G and 4G mobile services. It serves blue chip customers like Shell, Royal Caribbean and Digicel. And even the military is interested: O3b is also working with SES’s US Government Solutions unit, which serves the US military.

The roaring success of O3b proves that MEO satellites are driving a new era of connectivity.
Foray into new markets: The smart ship

An impressive example of MEO satellite’s new-found success is O3b’s ability to serve the large cruise ships market.

At nearly 170,000 Gross Tonnes, a length of 350 metres and 18 decks, Quantum of the Seas is one of the largest vessels in the world and the home-away-from-home for almost 5,000 passengers.

The unique differentiator is an O3b beam which constantly follows this floating city as it sails through the oceans. O3b provides 300 times the transmission capacity of a standard cruise ship and delivers more bandwidth to Quantum than the whole of the cruise ship industry combined. With the massive bandwidth provided, passengers on-board the world’s first “smart ship” are able to watch videos online, monitor their social media profiles, experience Xbox Live “blazingly fast” gaming and check their travel details, restaurants, on-board programmes and whereabouts of their luggage.

A new travel experience is born, and with it a new paradigm and an emerging, vibrant market. From now on, any cruise ship operator which wants to differentiate itself has to consider offering at least the same fibre-like connectivity.

And this is only the tip of the iceberg.

With the massive increase in connected and mobile devices foreseen over the next years, high speed connectivity with unbeatable efficiency is of paramount importance.

Ericsson says that by 2020, the world’s population will use 24 billion connected devices, with 6.1 billion smart-phone connections. Most experts see this resulting in an enormous demand for connected solutions in the automotive, health, consumer electronics and utilities areas which will eventually drive the revenue of mobile phone operators up to US$1.2 trillion.
In these highly contested new markets, the GEO-MEO combination gives SES an enormous advantage and a unique selling point.

Customers need to deliver connectivity to remotely scattered communities and, at the same time, provide massive bandwidth to more populated areas. They therefore need network architectures that correspond to both and cater efficiently to their diverse needs and the different characteristics of their offers, in terms of density, consumption, stability and mobility of their services.

The combination of GEO widebeams, GEO high throughput beams and MEO high throughput and low latency spot beams covers wide footprints and focused regions simultaneously. This makes it an ideal proposition for customers to develop entirely scalable, versatile and hyper-efficient network topologies. The pairing could even pre-empt the customers’ needs and give them a competitive edge that has never been possible before.

**GEO and MEO is the ideal proposition for customers to develop entirely scalable, versatile and hyper-efficient network topologies.**

### KEY FEATURES OF GEO AND MEO SATELLITES

<table>
<thead>
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<th>Feature</th>
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<th>O3b’s HTS satellites</th>
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<tbody>
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<td>Low latency</td>
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### BROADER PORTFOLIO OF SOLUTIONS

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<tr>
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<th>GEO HTS</th>
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Jumping on the GEO-MEO bandwagon

Smart first movers around the world are therefore jumping on the GEO-MEO bandwagon.

One example is Jamaica-based telco network Digicel which is providing communications to Nauru, Fiji, Tonga, American Samoa, Vanuatu and Papua New Guinea.

Digicel uses SES’s reliable and comprehensive C-band beams to deliver regional connectivity across the Pacific Islands, but also taps into O3b’s low-latency spot-beams to deliver fibre-like connectivity to more populous locations within Digicel’s networks. In PNG, demand for O3b capacity originally rolled-out in July 2014 has quadrupled to almost 2Gbps – such is the appetite for broadband connectivity. Digicel’s increasing demand for capacity clearly demonstrates the benefits of a combined GEO and MEO solution.

**Digicel’s increasing demand for capacity clearly demonstrates the benefits of a combined GEO and MEO solution.**

In Timor-Leste, India-based Bharti is using both MEO and GEO to meet the increasing demand for better mobile networks. The low latency and massive throughput of the MEO satellite enables Bharti to roll out 2G mobile services and new 3G services, while GEO capacity is critical in ensuring seamless connectivity.

Easter Island has also benefited from the rollout of O3b connectivity. Leveraging on both GEO and MEO capacity, Easter Island’s local population of 6,000 and average of 80,000 tourists per year have reliable and faster broadband access, and now enjoy 3G and 4G mobile services.

Then there’s Democratic Republic of Congo (DRC) in Africa, a country of more than 70 million people, including 10 million in the capital city of Kinshasa. In the land-locked country, 500 Mbps of low-latency MEO capacity is used for delivering high-speed broadband services mobile backhaul services to connect both urban and rural hubs, while GEO capacity remains essential in connecting remote offices with their headquarters in Kinshasa and delivering TV channels across the country.
Transforming the connected landscape

These examples show how SES and O3b, through their GEO-MEO pairing, are enabling customers to develop solutions that were unheard of and inconceivable just a few years ago.

The perfectly complementary match between GEO and MEO satellites, the scalability and flexibility of the two fleets enable SES and O3b to effortlessly cater to enormous and growing future demands.

We are on the verge of witnessing a steep connectivity demand curve over the next years and decade. Satisfying the emerging needs of untapped or unconnected geographies and segments does not saturate these markets, but instead fuels further demand and creates exponential growth.

The combination of GEO and MEO fleets is a technological breakthrough that is transforming the connectivity landscape. The essential advantage of the combined offering is the key differentiator in delivering reliable and fast Next Generation Data services across many different sectors and geographies.

It opens up new horizons for SES, its customers and markets.

The match between GEO and MEO satellites and the scalability of both fleets offer an essential advantage to customers and will fulfil growing future demands.
GEO & MEO:
SES and O3b Networks
taking you to new horizons

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Published in September 2015.
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