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The fourth "Sure Thing" in our lives.

My old dad used to say to me, "Lad, there are three sure things in life: birth, death and taxes". Today, my kids have convinced me there is another much more important sure thing – data connections! How do I know this? Easy, as a result of the constant refrain, "Dad, the internet is soooo slow, again!"

The demand for faster and faster data connectivity has clearly become the fourth essential element in our lives. Some notable billionaires, social networks and investment companies clearly see this as a business opportunity, and are investing heavily in second-generation satellite technology.

The new first-generation satellite technology, using Geostationary (GEO) satellites, has started to be launched, and it represents a considerable investment in new satellites by the existing satellite fleet owners including Inmarsat, Intelsat and Viasat, to name but a few.

For the second-generation projects, there are at least two identified billionaires who are in this battle to bring cheaper and faster internet to the masses over a 5-10 year period by launching fleets of Low Earth Orbit (LEO) satellites.

In November 2014, Elon Musk, CEO and CTO of SpaceX, ex Tesla cars and PayPal, confirmed he was building a fleet of 4,000 Low Earth Orbit (LEO) satellites to provide affordable internet to the masses. He officially announced the project in January 2015 with a combined announcement that Google and Liberty were investing $1billion in his project.

A couple of weeks earlier, Sir Richard Branson of Virgin announced that he was investing an unknown sum, together with Qualcomm the integrated chip manufacturer, in Greg Wyler's project OneWeb to launch 648 micro-satellites into Low Earth Orbit (LEO).

In early March, Vern Fotheringham, the newly appointed CEO of a third new project, called LeoSat, announced that they plan to launch 120-140 high power Ka band satellites into LEO for global internet. Vern didn't disclose who the LeoSat investors are, but no doubt another billionaire or two are joining together with a couple of investment companies.

Concept of Leosat satellite network. LeoSat plans to launch 120-140 high-power Ka-band satellites into low Earth orbit for global data transfer. Credit: Leosat

Vern made it clear that the project is not aimed at the three billion people who don't have internet access when he stated, "Internet for the multitudes, it is not. You hear talk about serving the other 3 billion unconnected — a wonderful thing for Google or Facebook. We are a commercial company. We'll stick with the top 3,000 rather than the other 3 billion."

First-Generation Satellites to be in service from end 2015

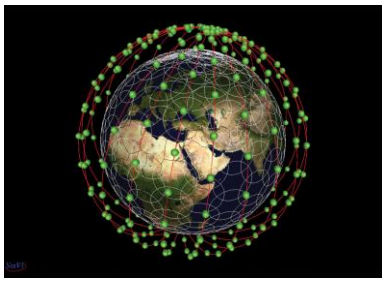
The first-generation satellites being launched now are the Inmarsat Global Xpress constellation of four satellites. Two have been launched to date, and a third will be launched later in 2015. Once three are in orbit they will provide global coverage. The fourth is to be used to provide additional service to high demand regions. These satellites will provide a fast global Ka band service combined with a slow L band backup when outside the Ka band footprint or in bad weather.

Telenor will be the next to launch a new satellite. Thor 7, a Ka band, regional satellite will be launched on 15th April 2015. This will provide high bandwidth across the Med and Gulf.

In early 2016, Intelsat will launch their new Ku band EPIC satellites which will then complete Intelsat's global coverage complementing their existing fleet of wide beam Ku band satellites with these new High Throughput Satellites (HTS).

The move is from current GEO satellites to LEO

Almost all the existing satellites in space and the new first-generation satellites are Geostationary (GEO) satellites whereas the second-generation satellites will be Low Earth Orbit (LEO).



Why?

GEO satellites are in a Geostationary orbit, which is 22,000 miles above the surface of the earth. At this distance, the satellite rotates in sync with the earth. From our perspective on terra firma, it's as though the satellite is stationary above our heads. However the large distance results in high latency, which makes satellite internet a poor option for many applications, like gaming, video conferencing, telephone calls and web-browsing. Everyone will have witnessed on the TV News the delay between a remote reporter being asked a question and their reply to it. This is called latency. The satellites are also larger and costlier, raising the price of internet services available through them.

Low Earth Orbit (LEO) will be much closer to the Earth at about 680 miles from the surface. The latency is estimated to be 20ms to 30ms, which is comparable or better than using land-based and under-seabed based fibre optic cable. This is because the speed of light in a vacuum is 40% to 50% faster than in fibre.

With the benefit of improved latency, the key advantage of LEO satellites will be price and performance. We will see performance equivalent to fibre optic on the ground at a fraction of the cost of today's satellite internet.

However, LEO satellites are on the move, orbiting around the earth, so how does a satellite dish keep tracking a moving satellite?

LEO projects have previously failed for want of affordable "intelligent" antennas.

Because we have been using Geostationary satellites that don't move, ground based satellite dishes have just been "unintelligent" parabolic fixed dishes.

Some years ago, the LEO concept had some billions of dollars poured into it. Notably into a project called Teledesic of which Bill Gates was one of the main investors. The reason it failed was because a reasonably priced, ground based, "intelligent", tracking dish could not be developed. Today, the most basic and cheapest "intelligent" tracking dishes are the same as those we install on superyachts to track current Geostationary VSAT satellites whilst the yacht is moving. At $40,000 a shot, this is clearly not a solution that villagers in Africa would buy into!

Royal Caribbean ships are tracking O3b orbiting satellites and they have to use three 2.4m stabilized antennas. These are not cheap and they need an awful lot of real estate to accommodate them.

The secret here is the development of low-cost, electronic beam-forming antennas, such as those Kymeta is developing, that allow tracking and signal hand-off. The technology development and proof of technology has all been accomplished. The next wave of product development is at hand with major equipment manufacturers, so this will be a technology that can be used.

What's the difference between SpaceX, OneWeb and LeoSat?

Both SpaceX and OneWeb are aiming for the same market, which is the 4 billion people in the world who do not currently use the internet ,whereas LeoSat make no bones about the fact that they are after the wealthy, existing users who just want more of what they already have, and can afford it.

Space X and OneWeb are very large constellations with small satellites with modest onboard power. LeoSat is putting a high-capacity platform into service to solve some of the most intractable communications problems that industry and government have faced over the years.

To top that, SpaceX and OneWeb have a fundamental difference in their similar approaches, so it will be interesting to see who wins.

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