An aerial photograph of a wind farm with several wind turbines. A network of white lines connects the turbines, representing a satellite IoT network. The background is a misty, hazy landscape.

WHY ENTERPRISE IS RECOGNISING THE VALUE OF SATELLITE IOT

**WITH A FOREWORD
BY KEVIN ASHTON**



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FOREWORD BY KEVIN ASHTON

INVENTOR OF THE "INTERNET OF THINGS"

It is easy to mistake the transformational nature of the Internet of Things for something less: as a buzzword perhaps, or merely the latest fashion for technerds, and so to be discarded. This is partly because, in nations with advanced economies, the Internet of Things marked the end of a long period of incremental change. Mass literacy led to daily newspapers and paperback books, broadcast radio led to broadcast television, telephones led to cell phones, photography led to cinema, personal computers led to digital cameras, portable computers, and the internet, and then the Internet of Things.

But, nations with advanced economies are home to less than fifteen percent of the global population, and the wrong place to look to easily see the transformational nature of the Internet of Things. In the rest of the world, which is almost all of the world, the Internet of Things is an information revolution come all at once.



Ethernet, Wi-Fi, and cellular networks are necessary but not sufficient: by themselves, they cannot provide the redundancy, global coverage, low latency, and reliability that are prerequisites for what is now an essential Internet of Things infrastructure. ”

Every previous information technology has spread slowly and unevenly. Writing diffused over millennia. It took 2300 years for Latin to develop a writing system, and 3800 years for English to develop one. Landline telephones first became available in the 1870s, but only one in fifty people had access to one in 1948, and only one in five people had access to one in 2000.

The Internet of Things, in contrast, arrived almost instantly.

One way to see this is by looking at the impact of Internet of Things on cellular networks. In 2011, almost one hundred percent of the world's cellular network traffic came from voice calls. In 2015, as the Internet of Things started expanding, voice calls fell to fifteen percent of cell network traffic. By 2020, voice calls were three percent of cell phone network traffic. By 2025, voice calls will be only one percent of cell phone network traffic. Everything else will be data, almost all of it captured by the Internet of Things.

Another way to understand the transformation is by counting all the automatic data sources connected to the Internet of Things. Here's a random example: you can open an app on your phone and discover the current weather in Dakar, Senegal. You may not have heard of Dakar, or even be able to find it on a map, and yet your phone knows whether it is raining there. How? Because you are connected, via an unimaginable tangle of intermediary cables, corporations, databases, government agencies, interfaces, protocols, radios, satellites, servers, standards, and routers, to the automated weather observing system at Dakar's Léopold Sédar Senghor International Airport, which contains a sensor array with an ultrasonic anemometer to detect wind speed, a thermometer made from platinum wire

to determine temperature using electrical resistance, and a light emitting diode differentiates between rain and snow by seeing how the drops twinkle in its infrared light. These sensors broadcast their readings using radio waves every hour, or more frequently if Dakar's weather is changing rapidly.

There are over ten thousand automated weather observation devices like the one in Dakar spread across the surface of the earth, and thousands more speckling the seas and skies. The heights of ocean waves, are constantly being measured by a wireless network of fifteen hundred floating buoys using magnets and accelerometers. Some of the buoys also emit ultrasound to calculate the speed and direction of the oceans' currents. All over the world, other automated sensor networks detect other things, including air pollution, earthquakes, floods, traffic, wildfires, and even whether the ice-cream maker in your local McDonalds is broken. The Internet of Things includes all these sensors and billions more besides, and has become a mission critical utility technology for the entirety of humanity.

But sensors are only half the battle. All those sensors need networks, and the Internet of Things is nothing without connectivity. Ethernet, Wi-Fi, and cellular networks are necessary but not sufficient: by themselves, they cannot provide the redundancy, global coverage, low latency, and reliability that are prerequisites for what is now an essential Internet of Things infrastructure. The missing piece of the network is a satellite-based Internet of Things communications architecture. Or, rather, it was the missing piece. Now, as this excellent and timely white paper shows, that piece is not missing anymore.

WHY BUSINESSES ARE RECOGNISING THE VALUE OF SATELLITE IOT

Satellite connectivity is the only method of ensuring high and narrow bandwidth, reliable, connectivity at the required latency anywhere in the world. It is finding growing favour among organisations that rely on global connections to power their Internet of Things (IoT) initiatives who are turning to satellite connectivity to augment and support other types of networks for IoT use cases. From mine operators to farmers and mariners to the oil and gas industry, resilient satellite networks are the enablers of compelling, mission critical IoT use cases – over land, sea and air.

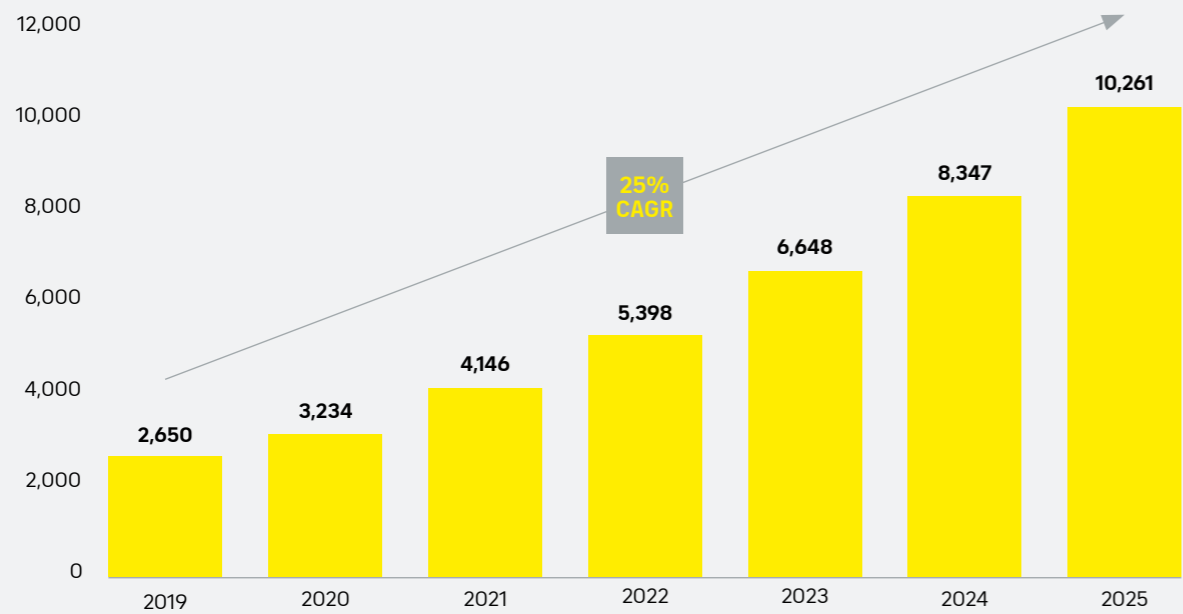
There are many things to consider when choosing a satellite provider for IoT. There are a whole host of satellites of all shapes and sizes orbiting the earth; from those as big as a bus, to those as small as a soda can. Satellites are also operating at a variety of different orbits from 400km to over 30,000 km, which generally dictates whether they orbit with the earth or they orbit around earth. Differing constellations also use different radio frequencies, which possess differing qualities.

The multiple options and growth among satellite connectivity providers reflect an increased demand for satellite IoT, which is borne out by recent research from analyst firm Berg Insight. Berg's research has uncovered that, in spite of the pandemic, the global satellite IoT subscriber base grew to more than 3.4 million connections in 2020. The firm has also projected that this number will grow at a CAGR of 35.8% to hit 15.7 million units in 2025. This represents a massive opportunity for satellite IoT communications given that still only about 10% of the Earth's surface has access to terrestrial connectivity services.

Others also see buoyant growth. Research firm Omdia projects a CAGR of 25% in satellite IoT connections between 2019-2025. While in revenue terms, Transparency Market Research projects the market will exceed US\$6.14bn by 2031, expanding at a CAGR of 22% from 2021-2031.

Cumulative Global Satellite IoT Connections, 2019 - 2025

Cumulative Connections in Thousands



Source: Omdia



LEO, MEO AND GEO

Satellite connections can be delivered using three widely adopted orbital approaches – low earth orbit (LEO), mid-earth orbit (MEO) and geosynchronous or geostationary earth orbit (GEO) satellites. With few commercial MEO constellations in orbit we have focused our analysis on the options that are most popular in the market, namely GEO and LEO satellites.

While many GEO constellations are able to point to a history of proven technologies, with established use cases and business models for IoT, there are a new wave of LEO satellite networks under construction, but does the hype live up to the reality? The excitement surrounding LEO activity stems from claims that have been made suggesting that LEOs are less costly and faster to launch while offering lower latency, but how true are these claims and how valuable is this for the customer? Further attention has been garnered because of the multiple huge investments being devoted to LEO constellations, examples of which include Elon Musk with Starlink and Jeff Bezos with Project Kuiper.

Both Starlink and Project Kuiper plan super-constellations involving thousands of satellites and these projects' wealthy backers may help them to evade the financial difficulties that other providers have seen in the LEO market. Historically these issues have been attributed to unclear business cases for their technology and the capital intensive nature of putting large constellations in orbit.

While it may be far cheaper to build and launch LEO satellites, per satellite, than GEOs, the sheer number of satellites needed and a shorter lifespan, per satellite (5-7 years vs 15-25 years in GEO satellites) means that overall costs are much higher than a typical GEO constellation.

With many LEO constellations still under construction, continuous coverage is not yet a reality and costs and complexity increase as more satellites are added, with regulation and orbital congestion also becoming factors to address. Much of the LEO market is therefore fragmented and faces challenges in delivering the ease-of-use and resilience of the far longer-established GEO market.

LEO and MEO satellites also require tracking antennas to follow them across the sky, making earth-based hardware devices much more complex and costly than those that only require simple parabolic antennas. The constant movement of LEO satellite means that the signal can drop out as the terminal moves from satellite to satellite. This can lead to data points being lost. Conversely, because of their larger beams that stay constantly fixed, GEO satellites are great for mobile use cases where an asset may move inside that beam and still stay connected to the same satellite so there are no drop outs and lost data.

LEO constellations must also create a dense global footprint of teleports or ground infrastructure that is required to transmit and receive satellite signals and route traffic from the satellite to the internet. Again these can be challenging to build due to geopolitical and regulatory changes. Operators also need to gain licences to operate in each country they plan to do business in, which can take time and cause delays in the launch of services. In contrast, GEO satellite operators have their constellations already operating in space, have regulatory landing rights, established ground stations in secure locations, successful distribution channels and end-user equipment which is continuously improving to meet the needs of IoT.

Geostationary and high-earth satellites orbit at an altitude of approximately 35,800km above mean sea level which makes them both costly to deploy and subject to higher latency than LEOs and MEOs. For most IoT applications a delay of a few milliseconds has no appreciable impact on performance so a system monitoring a ship's engine, for example, would suffer no performance degradation from this type of fractionally increased latency.

Mature, stable, reliable, ubiquitously available service is what sets GEO apart from other satellite offerings, as an approach for delivering mobile IoT connectivity. On the other hand the prevailing claims about LEOs are

that they are highly suitable for consumer applications, delivering bandwidth at an affordable cost to users in previously difficult to reach or ignored areas. GEO, LEO and MEO approaches each have benefits and combining them along with terrestrial connectivity methods like cellular can help provide customers with the best experience. Inmarsat's ORCHESTRA network does exactly this, combining GEO L-band and KA-band with a LEO constellation in certain high-traffic areas.



Mature, stable, reliable, ubiquitously available service is what sets GEO apart from other satellite offerings, as an approach for delivering mobile IoT connectivity.



FROM NANOSATS TO MEGA-CONSTELLATIONS

Nanosatellites, or nanosats, have existed for more than a decade although uptake is starting to accelerate. A nanosat is a satellite weighing between 1-10kg. Continued advances in miniaturisation and electronics performance have seen nanosats develop from performing basic video monitoring of areas, typically carried out by governments, to becoming capable of performing commercial missions.

At the other end of the scale, GEO satellites are often much bigger. For example, Inmarsat's I-6 which is the largest and most sophisticated commercial communications satellite in existence, weighing in at 5,470kg, with a body of 7.5 metres and a wingspan of 47 metres.



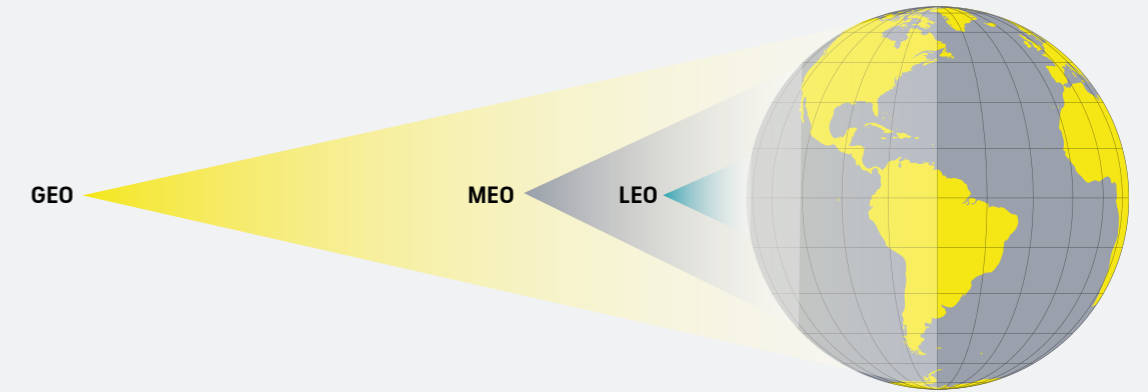
The reduced payload of nanosatellite can make them cheaper to launch and manufacture, per satellite, and as costs further reduce they are becoming increasingly feasible for deployment to support a wide range of applications. The rise of nano satellites has also led to an increasing pool of satellite IoT solution providers focused on building a small constellation and focusing on a limited – often vertical specific – set of use cases. There are some challenges associated with this model however; with a handful of nano sats in orbit each solution provider may offer data collection at widely spaced intervals or focus on a specific geographical region. This is acceptable only for non-mission-critical data points that do not need to be collected regularly.

In many cases some would-be nano satellite solutions operators are turning to established GEO network providers for help. Instead of spending available funding on building their own, potentially limited satellite constellations, they can focus on delivering the all-important solutions that are facilitated by the satellite connectivity. Essentially operating a virtual network on top of a GEO network provider saves CapEx and ongoing operational costs, helping provide their customers with a better experience.

In contrast to nano satellite operators with relatively small constellations, mega- or super-constellations are systems that utilise hundreds to thousands of LEO satellites to deliver low latency broadband data services anywhere on the planet. Typically occupying orbits between 400 and 1,200km, these constellations utilise small, low cost satellites, which is essential for the principle business case of providing static internet access to remote areas.

GEO providers on the other hand require far fewer satellites to be able cover the earth's surface. Three satellites are all it takes for Inmarsat to cover the globe, aside from the extreme poles, with its ELERA network.

GEO, MEO and LEO Satellites

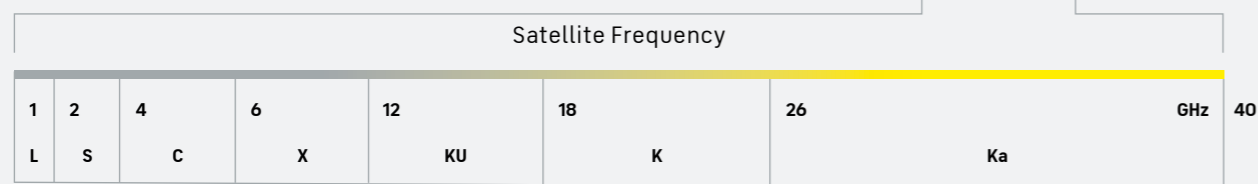
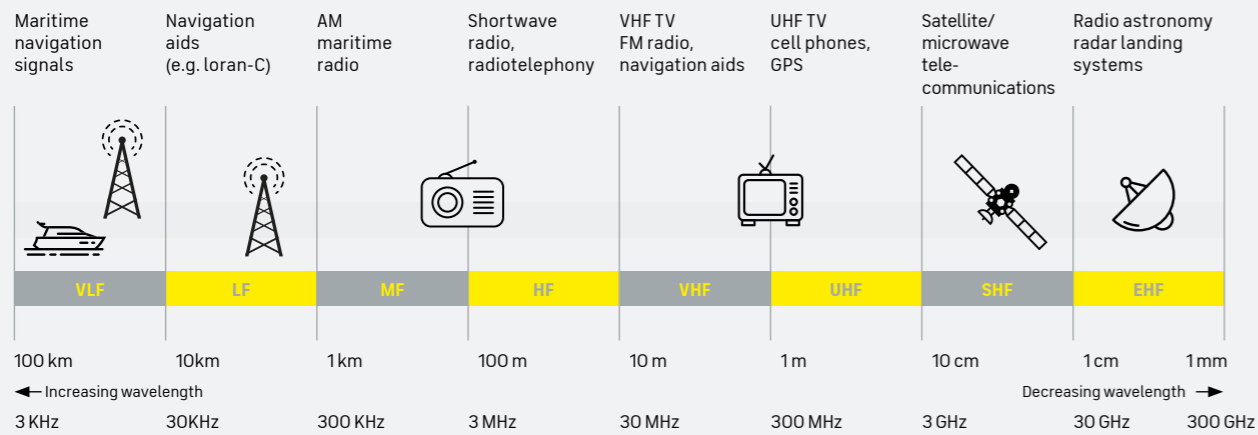


	GEO (~36,000 km)	MEO (~8,000 km)	LEO (~1,000 km)
Latency	Medium (~700 m/s)	Low (~150 m/s)	Very low (~50 m/s)
Network size for global services	3 satellites (99% coverage)	6 satellites (96% coverage)	Thousands of satellites (100% coverage)
Data gateways required	Few, fixed	Several, flexible	Numerous, local
Technology readiness level	Proven, deployable technology	Proven, deployable technology	Technology still in development for satellite internet
Costs to deploy network	\$1 - 1 ½bn	Approx. \$1 ½bn	\$5 - 15bn
Satellite design life (replacement cycle)	15 years	12 years	5 - 7 years

Source: Dgtl Infra

WHICH SATELLITE FREQUENCY BAND SUITS YOUR USE CASE?

Satellite communications breaks down into seven bands and popular use cases for each are listed below.



Source: ESA

Operating at 1-2GHz the **L-band** supports Global Positioning System (GPS) carriers, satellite mobile phones and two-way telemetry data transfer to provide highly reliable communications on sea, land and air.

The **S-band**, which operates at 2-4GHz, supports weather radar, surface ship radar, and some communications satellites, especially those of NASA for communication with ISS and Space Shuttle.

Primarily used for satellite communications, the **C-band**, which operates at 4-8GHz, is used for full-time satellite TV networks or raw satellite feeds.

Primarily used by the military, the **X-band**, operating at 8-12GHz, is used in radar applications. X-band radar frequency sub-bands are used for weather monitoring, air traffic control, maritime vessel traffic, defence tracking and vehicle speed detection for law enforcement.

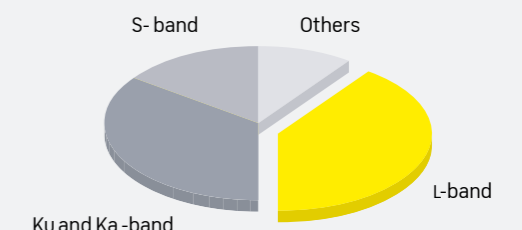
Used for satellite communications, the **Ku band** operates at 12-18GHz. In Europe, Ku-band downlink is used from 10.7 GHz to 12.75 GHz for direct broadcast satellite services, such as Astra.

Communications satellites utilise the **Ka band**, which operates in the 26-40GHz range, to uplink in either the 27.5 GHz and 31 GHz bands, and for high-resolution, close-range targeting radars on military aircraft.

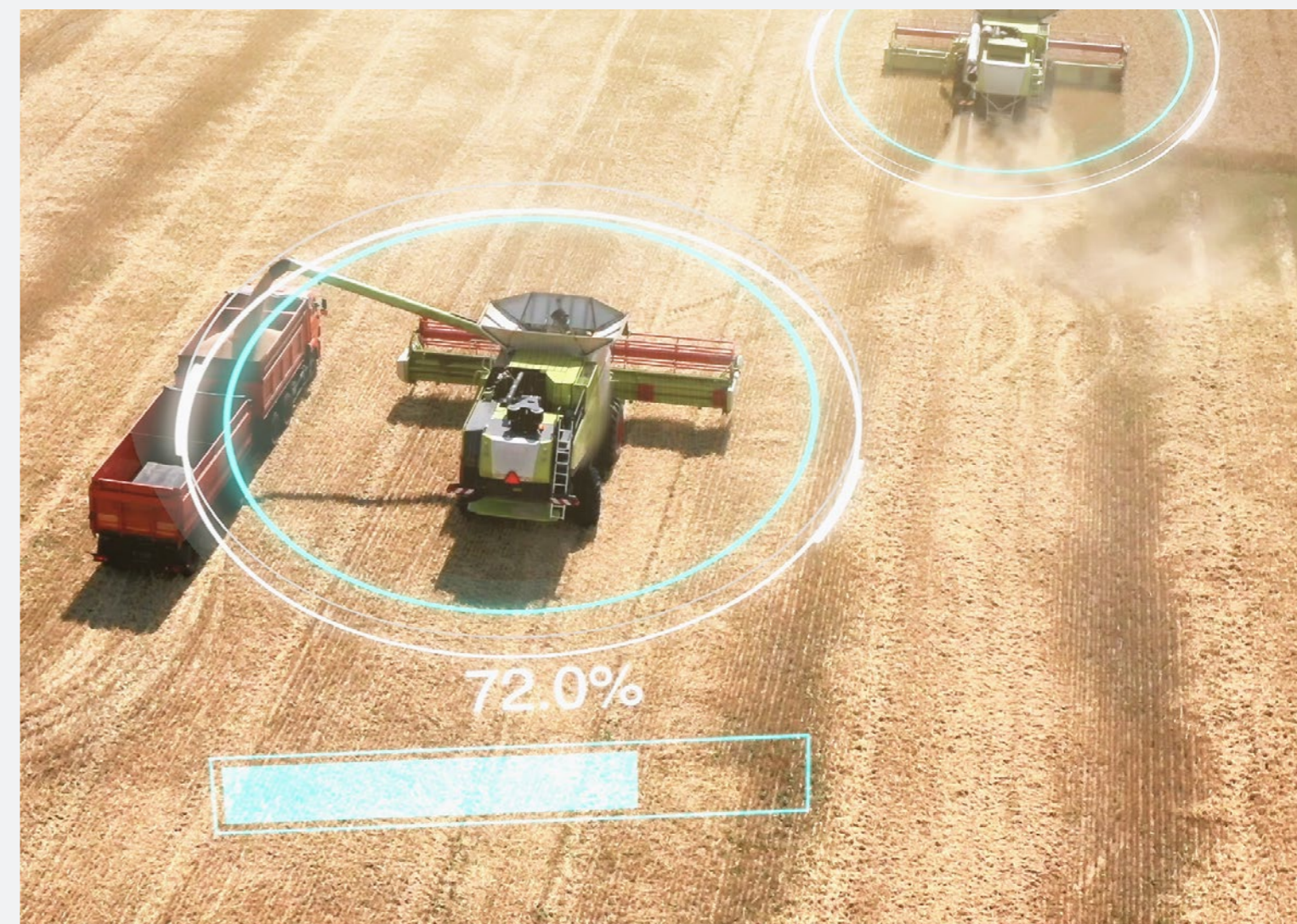
WHY L-BAND IS SO POPULAR FOR SATELLITE IOT

L-band's capability to deliver ultra-reliable, global, weatherproof connectivity makes it particularly attractive for IoT applications. Whereas some frequencies are prone to a phenomena known as rain-fade, L-band is largely resistant. Inmarsat's ELERA L-band network, for example, boasts 99.9% reliability. Transparency Market Research has estimated that L-band is the most popular frequency for delivering satellite IoT, with the segment having a market share of 41.6% in 2020. Technological advancements in L-band have spurred commercialisation in several end user industries, notably for extending IoT networks in remote environments. In particular, the growing use of IoT networks for real-time monitoring in the agriculture sector is expected to generate substantial growth opportunities, according to the firm.

Frequency Bands Used to Deliver Satellite IoT



Source: Transparency Market Research



SPACE JUNK AND THE KESSLER PHENOMENON

As the satellite industry has developed and other forms of space activity have increased so too has the amount of space debris or junk. Low earth orbit is becoming increasingly crowded as service providers accelerate their satellite launches. NASA estimates that there are millions of items of space junk flying about in LEO, mostly comprising pieces of spacecraft including parts of rockets and satellites that are no longer working. However, space junk also includes tiny flecks of paint from spacecraft and debris from explosions of objects.

The European Space Agency has reported that there are more items of satellite debris in space than there are operational satellites, with 23,000 larger objects tracked every minute to detect potential collisions with satellites or the International Space Station. A phenomenon called the Kessler Syndrome suggests that with more objects crashing into each other there is the risk that we could reach a point where objects crash into each other exponentially. This could result in extreme difficulties in launching space craft out of the earth's atmosphere, as well as bringing down those constellations already providing communication services.

Scientific journal Nature has said that satellite re-entries from the Starlink mega-constellation alone could deposit more aluminium into Earth's upper atmosphere than that deposited through meteoroids and thereby could become the dominant source of high-altitude alumina, which in turn has the potential to deplete the ozone layer. The article also reported that untracked debris will lead to potentially dangerous on-orbit collisions on a regular basis due to the large number of satellites within mega-constellations.

The United Nations Office for Outer Space Affairs (UNOOSA), has reported that more than 11,000 objects have been launched into outer space. This includes satellites, but also probes, rockets and other devices. For GEO satellites the lower number of items in a similar orbit greatly reduces the risk of collision, while transmission is minimally affected by space junk. Many GEO operators incorporate carefully crafted decommissioning plans into their design in order to limit the impact of GEO satellites when they have reached the end of their lengthy operating life.



SATELLITE IOT WITHIN A WIDER CONNECTIVITY ECOSYSTEM

Satellite IoT should not be seen as an either/or alternative to other forms of connectivity. Instead, it should be viewed as part of an organisation's IoT networking arsenal, to be used to augment other options and to be the core network for those situations where it is most reliable, or the fact that it is the only method available.

With recent Inmarsat research revealing that 75% of the IoT decision makers polled struggle to deploy their IoT projects because of issues with their connectivity, the value of reliable connections has been emphasised. Satellite connectivity has always proved itself in applications such as marine communications and for organisations that operate in remote locations, such as oil and gas companies. The ability to enable IoT connectivity regardless of location sets it apart from the patchy cellular coverage that exists in much of the world. In addition, the capacity that satellite offers is more than sufficient for the vast majority of IoT applications.

However, satellite has often been viewed as a specialised network, only suitable for very high value and extremely specific use cases. In IoT, it's essential that the cost of providing the service doesn't outstrip the value of the service itself and, for that reason, though the cost per kb has dropped substantially, satellite connections won't be appropriate for some low value, high volume, massive IoT applications. However; organisations are waking up to the fact that satellite can also be more cost efficient than they think.

As part of an organisation's IoT connectivity arsenal, satellite can play a key role as a back up to cellular connectivity, switching when an asset goes out of range or a mast is over-contended with data from elsewhere. Satellite's ability to interact with Low Power Wide Area Network (LPWAN) technologies also positions it as an enabling technology for massive IoT applications, with LPWAN communications and data aggregated for onward transmission via satellite. This aggregation makes the business case because data from hundreds of agricultural probes, for example, can be aggregated at the edge and then communicated via satellite for centralised processing.

For many deployments, especially those in established urban centres, abundant cellular or LPWAN capacity exists to support the differing needs of IoT use cases. For static objects, fibre connectivity represents a practical option while for smaller sites, Wi-Fi, notably Wi-Fi6 presents compelling performance at reasonable cost.

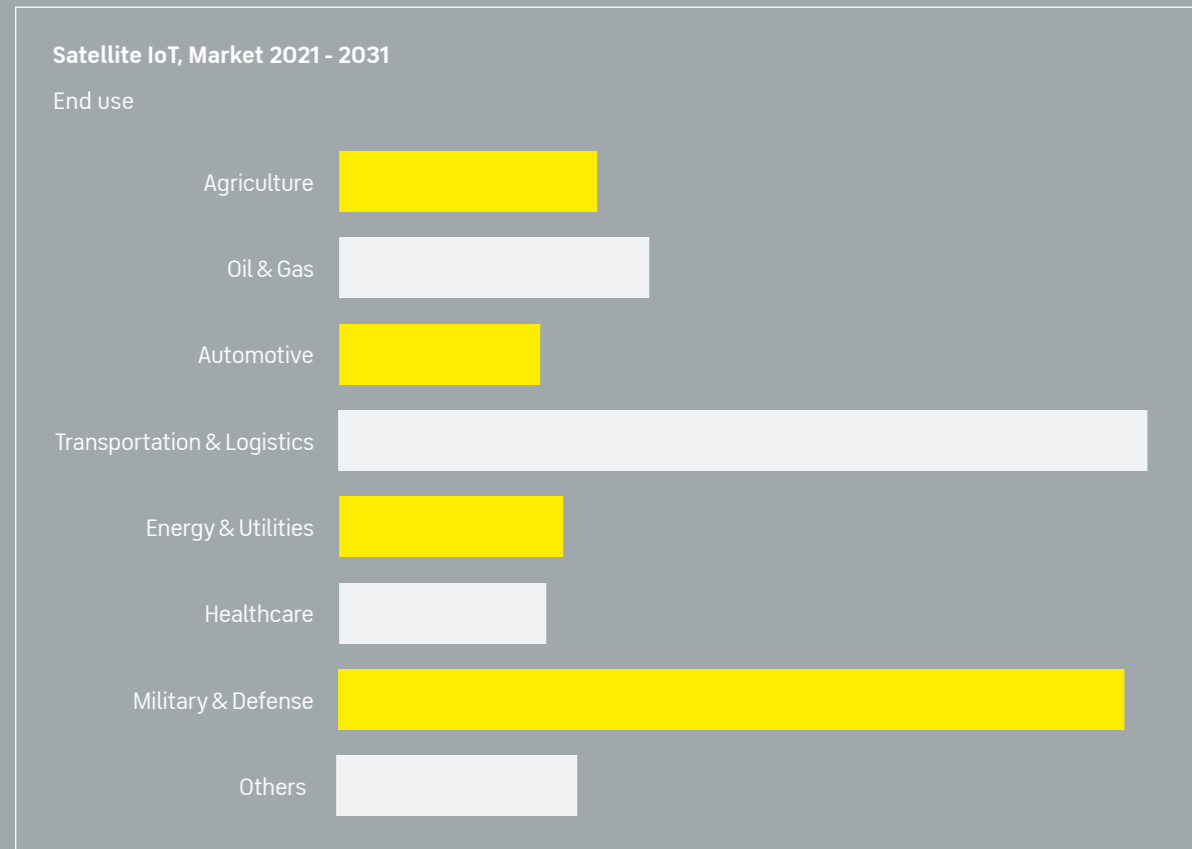
Add to this, the arrival of 5G which brings high speed and low latency capacity so mission critical IoT applications can be enabled in some locations for the first time. There are a wide array of IoT connection choices all of which are optimal in some cases but none of which are optimal for all situations. Aside from satellite connectivity, no alternative can connect IoT devices anywhere on the planet and therefore hybrid approaches to IoT connectivity are needed.

“
75% of IoT decision makers polled struggle to deploy their IoT projects because of issues with their connectivity”

It's important as IoT matures that satellite is not counted out as an option on pure cost grounds. Perceptions of satellite as a costly, luxury connectivity method are changing as the cost per kb decreases in line with the increase in data producers and data points. While it may not yet be at a point of parity with other connectivity types it has unique attributes that others simply cannot compete with. It is also worth noting that depending on the mission criticality of the data, customers are able to pay more or less to ensure the reliability of the service. Organisations adopting IoT should also consider the value satellite connections enable rather than the cost per kb of the transmission. Think in terms of the value of identifying leakage of an oil pipeline, or the cost of a low crop yield because of a failed crop irrigator and suddenly the satellite value proposition becomes compelling. On a day-to-day basis, knowing that a system is working thanks to sensor data transmitted by satellite, could be compared to the cost of truck roll by a maintenance engineer. From that perspective, satellite IoT clearly provides good value.

THE USE CASES

Ubiquitous coverage means that satellite-enabled IoT is applicable to a vast array of industries with some of the most valuable data points being created in the most inaccessible places. Satellite connections can help extract data right across the global supply chain from even the most inhospitable locations. In addition, with GEO mobility constellations, the benefits are not confined to static objects and high quality connections can be provided to multiple moving assets across land, sea and air. Below are just some of the use cases for GEO satellite connectivity in IoT.



Source: Transparency Market Research

Agriculture

In agriculture, field-based satellite IoT monitoring is ensuring full visibility into crop cultivation, with data gathered on weather, soil moisture, pest and disease monitoring. For livestock farmers, satellite connections are improving efficiency and peace of mind through real-time data, including water troughs, fences, animal tracking and remote cameras. New techniques such as precision farming and process automation are being

enabled by connectivity allowing optimisation of vehicle fleets to enhance productivity. In addition, connected control and monitoring infrastructure is enabling remote control of assets such as water pumps and access gates and management of irrigation systems, grain siloes and fuel tanks. This aids predictive maintenance and helps farmers identify problems and plan deliveries in advance.



Electricity utilities

With utilities companies increasingly moving towards smart grids, where electricity distribution and consumption can be effectively managed, companies are looking to monitor and automate reclosers, manage advanced metering infrastructure and address other aspects of the smart grid. Satellite connectivity can power this and aid workforce safety

optimisation. Connecting remote workers' wearable smart cameras connected over reliable and secure communications, optimises performance and safety of the workforce in the field. For security surveillance, video over satellite can validate any alarms that are triggered and provide additional information via better high-quality video.

Mining

Across the mining industry future-facing use cases are being deployed to deliver competitive advantage. IoT sensors at a drill rig can capture telemetry data which can be backhauled to a central location via reliable, highly secure satellite IoT connectivity. This real-time information underpins a smarter, more efficient decision-making process. Satellite IoT services enable geological analysis undertaken in the field to be relayed to headquarters in real-time, allowing drilling

efficiencies, and time and cost savings to be maximised. In addition, remote video inspection enables engineers in the field, wherever they are – and no matter how isolated the location – to communicate with headquarters in real-time, using HD video to troubleshoot on the fly, saving time and money. A growing use case is for UAVs to conduct remote visual site inspections providing a safer, more efficient way to survey mine sites.



Oil & Gas

Organisations throughout the oil and gas sector are adopting IoT applications that are enabling the remote control of infrastructure. With operations in remote and/or inaccessible locations, increasing safety and efficiency is a key objective. Satellite connections enable IoT solutions to control and manage artificial lift, drill rigs and oil pipelines – making difficult and

potentially costly operations safer and more efficient. UAV-enabled remote inspection, powered by satellite connectivity, dramatically reduces the need to travel to sites across the world to review assets, often in potentially hazardous conditions. This provides a positive environmental impact – saving fuel costs – but critically, supports a smarter and safer way of working.

Transport & Logistics

In fleet management, IoT-connected devices significantly enhance real-time visibility. This improves safety and fleet management by accurately identifying where transport assets are at any time, understanding fuel usage and providing feedback on whether drivers are adhering to safety procedures, as well as broader driver behaviour. Global satellite coverage enables

companies to take their assets anywhere and have the reassurance they will be covered. In an increasingly complex supply chain, the extra visibility IoT offers – tracking items in real-time – helps organisations understand and manage optimal transport conditions so quality can be assured for even the most perishable items such as foodstuffs or medicine cold chains.



WHAT SATELLITE IOT CAN DO FOR YOU

As the only way to ensure high bandwidth, resilient, low latency connectivity to any location on the planet, satellite IoT is the connectivity method that truly knits together every need of an IoT deployment. It is the only real way to augment fragmented cellular coverage by 3G and 4G networks, to address the enormous coverage gaps in 5G coverage and to provide long distance, high bandwidth, low latency backhaul to LPWANs. For proven outcomes, particularly for mobile and mission critical IoT, customers can be confident in the resilience and availability of GEO connectivity for their applications and devices on land, sea and air.

For the reasons outlined in this paper, satellite IoT is not an either/or solution to the IoT connectivity challenge. It is not ideal for all types of IoT deployments, nor for all locations but it inescapably is the only technology that is mature, operational and able to augment and integrate in any location with the other communications technologies that are powering IoT. The question should no longer be whether you can justify the cost of satellite IoT but whether your deployment can do without the value it adds.

ELERA IOT – A UNIQUELY VERSATILE SATELLITE IOT PLATFORM

ELERA IoT is Inmarsat's IoT platform. Built on the ELERA L-band network, the global network for satellite IoT and narrowband communications, it features proven connectivity services such as IsatData Pro, BGAN M2M and ELERA IoT Leasing. Further enabling the entire IoT ecosystem, the Inmarsat ELEVATE programme for

solution providers helps businesses integrate satellite connectivity and scale. Inmarsat is proud to provide the network infrastructure to end-to-end IoT solution providers such as Orbcomm, Hiber and Skylo.

[Find out more at inmarsat.com/eleraiot](https://www.inmarsat.com/eleraiot)

ABOUT INMARSAT

Inmarsat is the world leader in global, mobile satellite communications. It owns and operates the world's most diverse global portfolio of mobile telecommunications satellite networks, and holds a multi-layered, global spectrum portfolio, covering L-band, Ka-band and S-band, enabling unparalleled breadth and diversity in the solutions it provides. Inmarsat's long-established global distribution network includes not only the world's leading channel partners but also its own strong direct retail capabilities, enabling end-to-end customer service assurance.

The company has an unrivalled track record of operating the world's most reliable global mobile satellite telecommunications networks, sustaining business

and mission critical safety and operational applications for more than 40 years. It is also a major driving force behind technological innovation in mobile satellite communications, sustaining its leadership through a substantial investment and a powerful network of technology and manufacturing partners.

Inmarsat operates across a diversified portfolio of sectors with the financial resources to fund its business strategy and holds leading positions in the Maritime, Government, Aviation and Enterprise satcoms markets, operating consistently as a trusted, responsive and high-quality partner to its customers across the globe.

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