www.apscc.or.kr

APSCC

Asia-Pacific Satellite Communications Council

5G VIA SATELLITE

5G via Satellite

Leveraging 5G to Become a Mainstream Technology

Satellite and Mobile Networks: Partners for the 5G Future

INTERVIEW

Adrian Steckel, CEO, OneWeb

FOCUS ASIA

Why Networking Architecture and Satellite Technology are Key to Powering 5G in Asia

2019
NEWSLETTER

APSCC
Asia-Pacific Satellite Communications Council

T-1602, 170 Seohyeon-ro Bundang-gu, Seongnam-si, Gyeonggi-do 13590 Rep. of KOREA
Tel: +82-31-783-6244 Fax: +82-31-783-6249 E-mail: info@apscc.or.kr Website: www.apscc.or.kr

CONTENTS

3rd Quarter 2019, Vol. 25. Issue 3. ISSN 1226-8844

03 **MESSAGE FROM THE PRESIDENT**

04 **FEATURES: 5G via Satellite**

04 **5G via Satellite**
Winee Lutchoomun, Consultant, Euroconsult

10 **Leveraging 5G to Become a Mainstream Technology**
Lluc Palerm-Serra, Senior Analyst, NSR

16 **Satellite and Mobile Networks: Partners for the 5G Future**
Chris Boyd, Senior Director, Vertical Market Solutions, ST Engineering iDirect

22 **INTERVIEW**

22 **Adrian Steckel, CEO, OneWeb**

28 **FOCUS ASIA**

28 **Why Networking Architecture and Satellite Technology are Key to Powering 5G in Asia**
Semir Hassanaly, Market Director, Cellular Backhaul and Trunking, Newtec

34 **APSCC MEMBERS**

36 **NEW MEMBER**

38 **CALENDAR OF EVENTS**

40 **ADVERTISERS' INDEX**

MESSAGE FROM THE PRESIDENT

This month our magazine is devoted to 5G via Satellite. While many of us have spent the past decade engaged in a spectrum battle waged with the mobile telecom community over reallocation of our C-band and Ka-band spectrum we have long recognized that 5G will also bring significant business opportunities for the satellite industry.

According to Winee Lutchoomun of Euroconsult, 5G is expected to be a big improvement over 4G in terms of latency, number of devices connected, access speeds, remote coverage availability as well as energy consumption. On a political level it will fuel the race between China and the US for internet dominance. Semir Hassanaly of Newtec points out that 38% of Asia still is without connectivity and anticipates that 5G will have a major role in bridging the digital divide.

Lluc Palerm-Serra of NSR explains that we should not see 5G just as "faster networks" but as the opportunity for satellites to become a fully integrated solution in the future of mobile communications. "In the past, Mobile protocols were developed following a closed approach. It was very difficult for adjacent technologies such as Satcom to participate in the ecosystem. Consequently, making 2G/3G/4G work over satellite requires enormous efforts in terms of traffic manipulation (acceleration, optimization, etc.)." In contrast, the evolution of 5G has been different, with the satellite industry very active in the 3GPP standardization body that is defining 5G protocols, enabling satcom to be fully interoperable and integrated with 5G networks.

Chris Boyd of iDirect explains that satellites can offload traffic from terrestrial networks using our multicasting capabilities for video content, edge caching and real-time mobile video broadcast streaming, thereby "preserving high-value wireless spectrum for latency-sensitive services."

Lluc Palerm-Serra of NSR agrees, saying that 5G multicast content to edge servers will generate close to $1 billion in satellite capacity revenues by 2028. Moreover, Lluc notes that "1 out of every 3 new dollars in capacity revenues for Backhaul in the next 10 years will be generated from 5G applications."

Then we have an interview with Adrian Steckel CEO of OneWeb who discusses their commitment to preserving and protecting our space environment by employing responsible design and operational practices for the space ecosystem by developing new technologies that can help protect our shared resource.

If you want to better understand the opportunities that 5G offers the satellite industry and the transformative power that 5G will generate for our industry and the communities we serve then look no further.

Finally, I look forward to our upcoming Conference and Exhibition in Bangkok from November 19-21, 2019 and I hope that you will join us!

Gregg Daffner
President, APSCC

5G via Satellite

Winee Lutchoomun, Consultant, Euroconsult

Introduction

5G is the next generation of mobile and wireless broadband technology expected to overtake 4G in terms of latency, number of devices connected, access speeds, remote coverage availability as well as energy consumption. Large-scale adoption of 5G with the high number of connected devices with an ultra-fast and highly reliable connectivity will reduce the time it takes for multiple sensors to collectively take decisions to the order of a few milliseconds enabling technologies like autonomous car, virtual reality, artificial intelligence and smart cities that can only be fully implemented once the data network catches up with technological advancements.

Industry stakeholders have identified several potential use cases for 5G networks, characterised into three categories by the ITU:

1. Enhanced Mobile Broadband (eMBB) – applications include augmented and virtual reality, enhanced indoor and outdoor broadband, enterprise collaboration, etc.
2. Massive machine-type communications (mMTC) – applications include smart homes and cities, smart agriculture, energy monitoring, smart tracking, etc.
3. Ultra-reliable and low-latency communications (URLLC) – applications include industrial automation, driverless cars, telemedicine and healthcare remote home monitoring systems, smart grids, etc.

For 5G, the core network will have to be re-designed. Small cells, for example, will play a pertinent role in handling the high data rate for individual users due to their ability to function like conventional cells with the addition of advanced techniques like MIMO (multiple-input and multiple-output), beamforming and millimeter waves for transmission.

The technological race

With connectivity viewed as the backbone of an autonomous future and an insurance for future technological superiority, it was anticipated that 5G would fuel the race for internet dominance. This comes in the midst of an escalating conflict between the United States and China over technology and economic leadership. Faced

IT'S ALL ABOUT THE CONNECTED EXPERIENCE.

Learn more at Hughes.com

Powering a Connected Future.

CONSUMER | ENTERPRISE | GOVERNMENT | DEFENSE

© Copyright 2019 Hughes Network Systems LLC. All Rights Reserved.
The HUGHES logo is a registered trademark of Hughes Network Systems, LLC, an EchoStar company

with growing concerns on information security, the United States has banned American companies from using any technological equipment that could be considered a national security threat and recommended other countries to follow suit. With technology hardware and software supply chains being globalised today and Huawei being the largest telecommunication equipment supplier in the world and the second most successful cell phone vendor (after Samsung) according to the IDC's Worldwide Quarterly Mobile Phone Tracker, this whirlwind of geopolitical rivalries promises a few bumps on the road to deployment, at the very least.

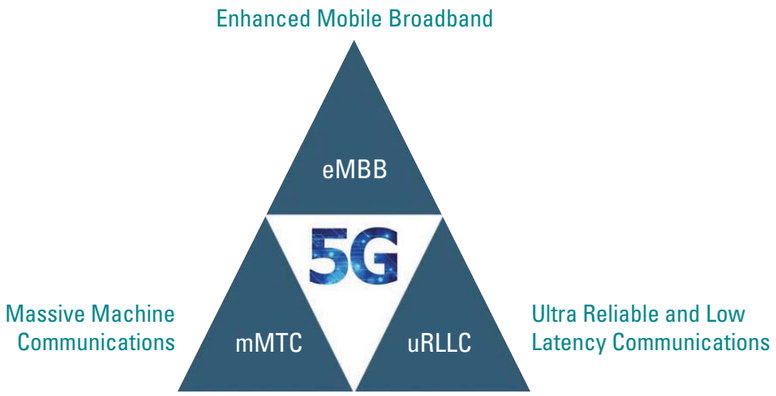
Adoption timeframe

Following the roll-out of 5G which is still at its early stage, the network is expected to initially operate in conjunction with the existing 4G infrastructure until subsequent releases and coverage expansions allow it to be a fully standalone working network. All the major smartphone companies are currently working on developing new internal antennas and processors for mobile phones that will be compatible with the 5G network. Some Android options have already been released by Samsung, LG and Motorola, even if the network itself is only present in some parts of a few cities in the world. In the US for example, only Verizon has deployed 5G in select areas of Chicago and Minneapolis. According to Ookla, a few customers in 19 other US cities are in the beta-test phase of the technology.

Key specifications

5G is expected to significantly reduce latencies from the current 210 ms for 3G and 60-98 ms for 4G to below 1 ms for URLLC data. The theoretical maximum speed is quoted by the ITU as 10 Gbps compared to 1 Gbps for the current 4G network (and 56 Mbps for 3G). Additional target requirements often attached to 5G are 50x bandwidth increase, over 1,000,000 connected devices/km^2, 100% coverage and availability and 90% more energy efficient. In the real world of course, there are limiting factors like data caps. For instance, a 100 GB data cap (much larger than most plans today) could be used up in under 2 minutes at the maximum theoretical speed of 10 Gbps.

With high speed comes high implementation complexity. Since 5G uses the millimeter wave (mmWave) which can only transfer data within very small distances, additional base stations, transmitters and signal repeaters are needed. This can be accommodated in metropolitan areas where a 5G node can be placed every few hundred feet. In rural areas with few cell towers on the other hand, the mmWave might not work. Slow procurement and implementation of the necessary hardware could result in extended deployment times and partial to no coverage in some regions. The mmWave is also very susceptible to weather conditions and atmospheric interference. To overcome these technological challenges, softening the divide between different technologies is essential.



Overview of the 5G standard development priorities (Sources: ITU and Euroconsult research)

Satellites for 5G

While much emphasis is being laid on the terrestrial means of coverage in the deployment of 5G, satellite technology and high-altitude platform systems (HAPS) will also play a pivotal role to complement the fixed and terrestrial backhaul networks, especially in rural and marine areas. With high data rates (of up to 1 Gbps) and low latencies (with LEO constellations), satellites can be integrated into the 5G solution to address some of the key challenges in providing truly ubiquitous coverage as well as supporting IoT. However, there are some complications with this integration.

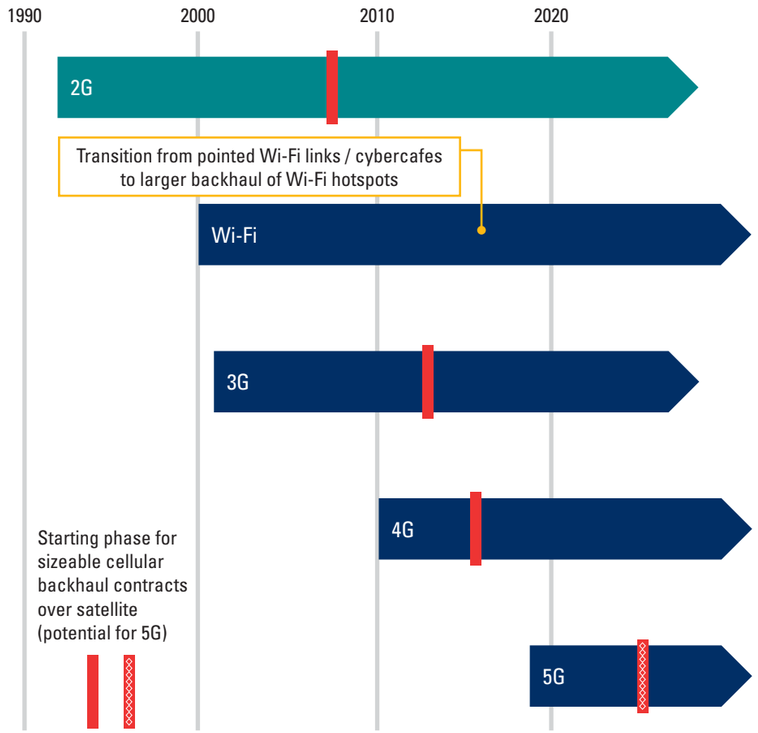
Satellites orbiting the Earth are located at a much larger distance than the typical distance between a cell phone and its serving base stations. This introduces delays in data transmission, especially when the satellites are in the GEO orbit. The long distance also adds pressure to the link budget and despite powerful antennas and power amplifiers, the user equipment will most likely have to deal with a lower signal-to-noise ratio. This would require better coding and modulation choices which in turn might lower the data rate further. With the relatively short orbiting period in the LEO orbit, the required frequent switchovers from one satellite to another can cause disruptions in data transfers, implying the need for additional redundancies in the system. And finally, the carrier frequency offset caused by the Doppler effects from the moving satellites will have to be corrected before adhering to the 5G specifications.

Stepping away from the technical challenges, there are some difficulties at higher levels that will have to be overcome as well. The spectrum requirements of 5G could step on the spectrum used by the satellite industry. Major operators like Eutelsat, Intelsat, SES and Telesat have recently planned to sell ~200MHz of the 500MHz C-band to 5G operators as part of the C-band Alliance. This ties to the larger issue of technology neutrality, the lack of which on behalf of governments, network operators, service providers and equipment vendors often drives standards and regulations and ultimately spectrum allocation and funding.

Despite multiple requirements that have been flooding the upcoming 5G network, it is clear that no single technology can sustainably meet all these conditions, neither are they all required for every single 5G application. Quite the reverse, several organisations have acknowledged that what is needed from 5G is to successfully adapt to the requirements of different applications. There are certainly times when the 5G latency benchmark will restrict satellite usage but not all applications are critically latency sensitive. To support its vision of a truly connected world, the 5G infrastructure will have to make use of several technologies all complementing one another namely small cells, satellite, Wi-Fi, traditional mobile wireless networks etc. Satellites offer three advantages that are critical to 5G attaining its goals:

(i) Remote area coverage

Satellites can cover land masses where there are no commercial incentives by terrestrial networks to install equipment for coverage (for example, isolated and remote areas) and ensure service everywhere, especially for critical communications (maritime and future railway networks). There is also a growing need to serve aeronautical markets.



Reference milestones for the development of Mobile standards (Source: Euroconsult)

(ii) Reliability

With terrestrial networks being vulnerable to natural disasters, satellites offer a good back-up with their ability to operate almost independently from terrestrial infrastructure, if need be. With less equipment involved (satellite, teleport, NOC, VSAT terminal), the probability of failure is significantly reduced. Also, because of the difficulty to perform repairs in outer space, satellites are inherently built with multiple layers of redundancy and reliability.

(iii) Cost-effectiveness

Satellites can improve the poor connectivity of terrestrial networks in underserved areas in a cost-effective way (for example, sub-urban and rural areas). Also, the capacity cost is independent of the number of users or the distance between communication points.

Realistically, terrestrial 5G will not be able to reach the coverage of 4G even in the next decade, with the requirement of a much denser network of base stations which will be achieved in large part via small cells. All the industry analysts agree that marine areas beyond the reach of terrestrial networks will continue to rely on satellites. The same applies for remote underserved regions where satellites can be used to connect 5G base stations to small cell stations in rural communities.

Gilat recently announced that it has successfully demonstrated the delivery of 5G services via one of Telesat's Phase 1 LEO satellite through a high throughput modem. Web browsing, video chatting, simultaneous streaming of 8K video, and transfer of 4K video to the edge of the 5G network were part of the experiment. This demonstration highlights the possibility of achieving seamless and high-performance connectivity that meets the stringent 5G latency standards and paves the way for future collaboration between the satellite operators of the emerging LEO market (Telesat, Amazon, SpaceX, OneWeb) and the big 5G stakeholders (Huawei, Qualcomm, Nokia, Samsung, Ericsson).

In summary, there is great potential for NTN (Non-terrestrial networks) in the 5G architecture to increase coverage and add redundancy to the system but the technical challenges to seamlessly engage satellites in the ecosystem have yet to be addressed. It will be interesting to monitor the 3GPP, the standardisation organisation responsible for developing the 3G, 4G LTE, and upcoming 5G wireless standards, discussions around the 5G NTN study item in the coming months to see the trade-offs made in terms of cost and benefit.

Phasing of satellite services with mobile standards

Contrary to popular belief, the deployment of new standards has historically benefited the satellite industry in that operators have been compelled to up their game and improve their technology to provide higher data rates and lower latencies at more competitive costs. A review of historical trends shows that the signing of sizeable contracts for 4G was triggered either by the anticipation or the rollout of HTS capacity in the region. 4G is currently still a major driver for the increase in satellite capacity requirements even if some developing areas are still deploying 2G sites. In any case, the need for participation in the ongoing 5G discussions on behalf of key satellite operators and solution providers to promote satellite as part of the solution cannot be stressed enough. Currently, key stakeholders like Inmarsat, Intelsat, Eutelsat and SES are working in close collaboration with the 5G working groups to demonstrate the added value of satellite technology and promote a "plug and play" integration.

Conclusion

With regards to satellites on 5G, we are currently in the study item phase with the final vote on adoption expected to happen in 2020. However, for the first time in the history of telecommunications, all the key stakeholders have agreed that to achieve a truly connected world, we have to make use of all technologies at hand, from wired to wireless, from terrestrial to non-terrestrial, to keep up the relentless pace with the evolutionary leaps made in the fields of AI and automation and bring ubiquitous high-speed connectivity cost-effectively to all users.

Winee Lutchoomun *is a Euroconsult Consultant specialized in satellite connectivity. With a master's degree in Aerospace Engineering from the University of Sheffield in the UK and another master's degree in Telecommunications and Signal Processing from McGill University in Montréal with a research concentration in potential compression algorithms for the upcoming 5G standard, Winee has a wide breadth of knowledge on the subject. Her core activities at Euroconsult include research, data analysis and contribution to consulting missions.*

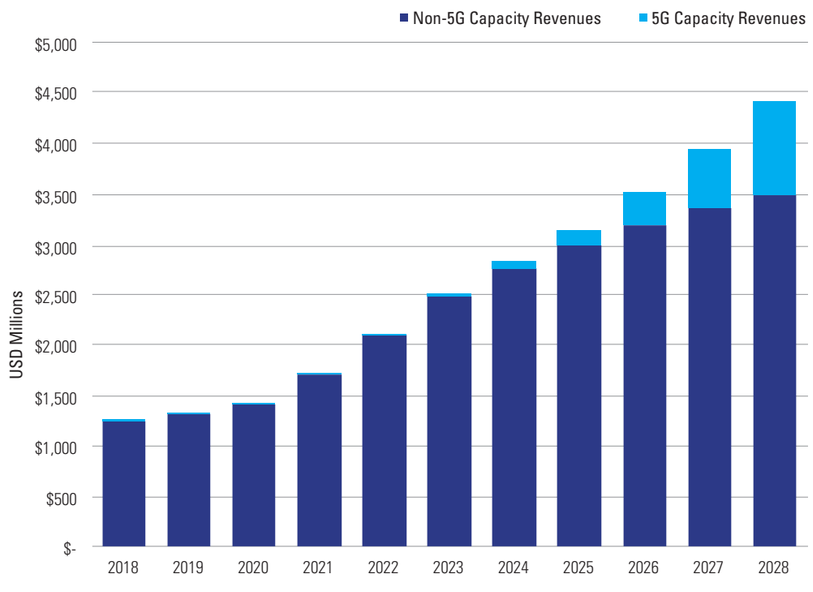
Leveraging 5G to Become a Mainstream Technology

Lluc Palerm-Serra, Senior Analyst, NSR

After years of buzz generation, 5G is now a reality with the first set of standards published on 3GPP Release 15* and initial deployments taking place around the globe. In previous Mobile generations (2G/3G/4G) the Satellite world was ignored and even marginalized but 5G encourages a completely new way of conceiving networks. And here is where the key opportunity for satcom resides. If the industry plays its cards well, 5G opens the opportunity for satcom to seamlessly integrate with the mainstream telecom ecosystem.

*(*https://www.3gpp.org/release-15)*

Satellite Backhaul: Capacity Revenues Breakdown



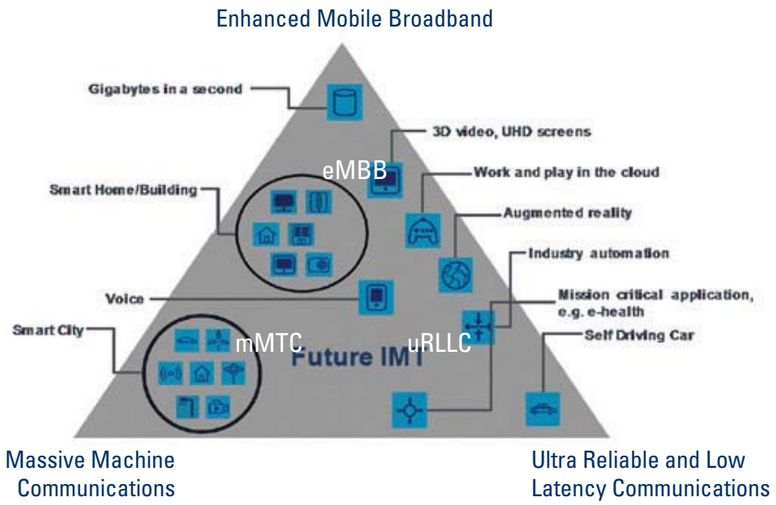
Source: NSR

The reality is that 5G goes well beyond cellular and aims to offer a unified network architecture where all access technologies work in sync, be it fiber, microwave, satellite, or others. Consequently, 5G can certainly become the next driver of growth for satcom and, according to NSR's Wireless Backhaul and 5G via Satellite, 13th Edition report, 1 out of every 3 new dollars in capacity revenues for Backhaul in the next 10 years will be generated from 5G applications.

The Role of Satellite in 5G

5G has generated a lot of hype around (eventual) extravagant use cases, some of them requiring extreme performance specs sometimes disqualifying satellite. However, to really understand the potential for Satellite in 5G, it is necessary to look closer into the different performance requirements. The ITU classifies the 5G use cases into 3 different families:

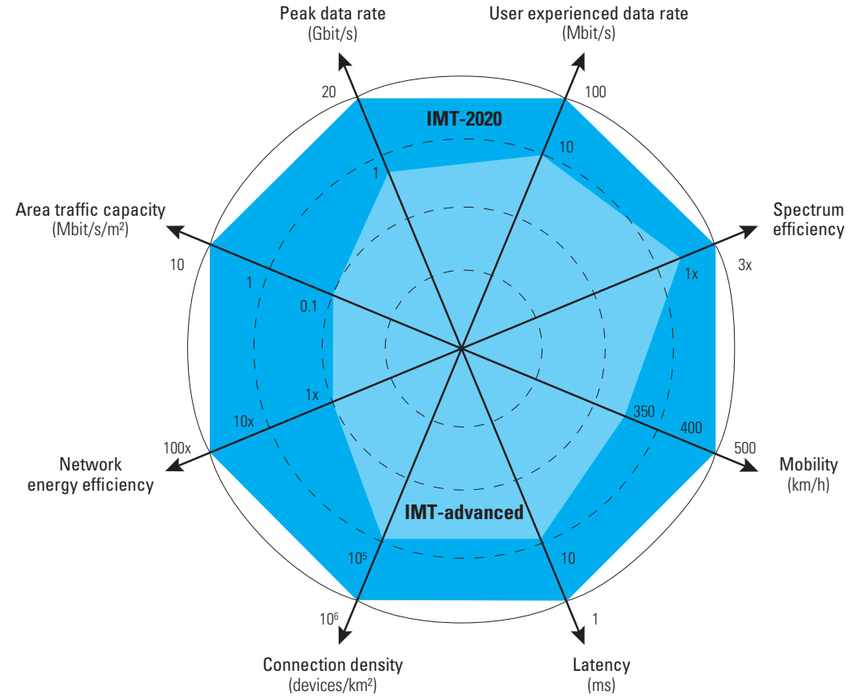
- Enhanced Mobile Broadband (basically faster speeds)
- Massive Machine Type Communications (IoT for everything, everywhere)
- Ultra-reliable and Low Latency Communications



5G Usage Scenarios. Source: ITU

With a clear role in Enhanced Mobile Broadband and Massive Machine-Type Communication, Satellite can perfectly serve 2 out of the 3 families of applications for 5G. Actually, satellites can offer an overlay to enhance network resiliency and achieve ultra-reliable communications so the only challenge for satcom is to serve low latency applications. Is this enough to disqualify satcom for 5G?

Performance requirements need to have the right context. 5G introduces network slicing, meaning that different clients will see different performance levels, and traffic could be routed intelligently depending on requirements. In parallel, 5G moves capabilities to the edge, and many of the ultralow latency requirements will be solved at the edge without the need for backhauling to the core, making satellite a viable solution. Otherwise, even terrestrial backhaul technologies would be unable to meet the 1 ms requirement.



Enhancement of key capabilities from IMT-Advanced to IMT-2020. Source: ITU

Another metric currently referenced to challenge the role of Satellite in 5G is the 20 Gbps per connection target. However, this target is for hotspot areas, and the minimum user experience data rate for wide area coverage is fixed at 100 Mbps, a benchmark achievable by satcom today. Furthermore, looking back to the history of LTE, the vision was to deliver 1 Gbps, but that promise wasn't realized until last year, 10 years after the standard was finalized. Even today, the minority of LTE networks meet that performance level*, such that NSR does not expect telco networks to meet purported 5G promises overnight.
(https://www.ericsson.com/en/mobility-report/reports/november-2018)*

Not only Satellite can meet 5G requirements but it will be a key enabling technology to facilitate emerging use cases like mobility or ubiquitous connectivity. That is why 5G is conceived to be more inclusive to incorporate other technologies under the same umbrella.

Opportunities in 5G

5G will undoubtedly generate numerous opportunities for the industry. 5G Cellular Backhaul and Hybrid Networks alone will generate close to $1 billion in satellite capacity revenues by 2028. However, the industry must be aware that this is a long-term race and despite the hype, 4G will still pay the bills for the next 10 years. 5G still needs time to develop and the impact won't be meaningful before the second half of the next decade.

In any case, 5G transcends cellular backhaul and creates opportunities across all satellite verticals. The user of 5G (be it a personal smartphone, a connected car or an IoT device) will be able to seamlessly move between networks without worrying about the access network. Additionally, many of the key use cases for Satellite in

5G can be stimulated, and even captured today:

- Backhaul: Beyond the traditional connectivity to remote locations, an easier integration with terrestrial networks could help develop new use cases like network resiliency, emergency response, IoT and network offload.
- Trunking: A long-established application that could see a boost with the arrival of 5G.
- Mobility: While 5G puts a lot of focus on connecting vehicles, there will be many instances where this would need to be complemented by satellite.
- Hybrid Networks: With capabilities moving to the edge, the explosion of OTT services and the transition to higher quality video, satellite will see the opportunity to multicast content to edge servers

Furthermore, 5G can have peripheral benefits. With the new generation, MNOs will accelerate the phase out of older 2G and 3G networks and push 4G further into rural areas translating into bigger bandwidth demand for satellite. Other benefits include offering a unified approach to connectivity for traditional enterprise VSAT networks adopting 5G standards.

Integrating Satellite in the 5G Ecosystem

What are then the concrete actions the industry needs to take to be 5G-ready? In the past, Mobile protocols were developed following a closed approach. It was very difficult for adjacent technologies such as Satcom to participate in the ecosystem. Consequently, making 2G/3G/4G work over satellite requires enormous efforts in terms of traffic manipulation (acceleration, optimization, etc.). That created tremendous barriers for the Satellite industry and it wasn't until very recently that edge-compute power allowed Satcom to penetrate those markets.

The mindset for 5G is very different and it aims to be much more open to all kinds of technologies in what some refer to as the "network of networks". Virtualization is a major theme for 5G, but also for the Satellite industry. With the new VHTS-class satellites, flexible payloads, LEOs, etc., it is a natural move for the industry to embrace virtualization. The smart move would be making those Satcom networks integrable in the centralized 5G network cloud, making Satcom fully interoperable with 5G networks. Orchestration with terrestrial networks is nothing new for the Satellite industry. The objective here is to make that orchestration standardized and replicable to make Satellite very easy to adopt by mobile operators.

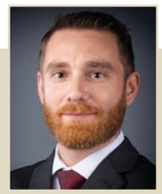
The good news is that unlike past experiences, the satellite industry has been very active in participating in the 3GPP standardization body that will define 5G protocols. With the second set of 5G standards planned by the end of 2019 (3GPP Release 16)*, related to that release is a specific study for 5G satellite access, which will identify satellite use cases. It is vital for the future of the industry to ensure that 5G protocols can work seamlessly over satellite networks, and now is the time to influence those standards. All these efforts create favorable traction for the Satellite industry.
*(*https://www.3gpp.org/release-16)*

Bottom Line

5G aims to change the way we interact and perceive the world to make it a digital experience. But it is way more than just better performances and exotic use cases, it is a completely new architecture aiming to orchestrate all connectivity solutions together. Satcom shouldn't see 5G just as "faster networks" but as the opportunity to become a fully integrated solution in the mainstream telecom ecosystem.

While some of the most hyped performance requirements for 5G seem unreachable by satellite (latency, throughput), the truth is that satellite will be a key enabling technology in the 5G ecosystem. 5G needs satellite to materialize its promises and with the appropriate context, satellite can perfectly meet the specs for 5G networks.

Embracing 5G will generate fantastic benefits for the Satellite industry. It will not only accelerate growth in traditional use cases like Backhaul and Trunking, but it has the potential to unlock new verticals like vehicle connectivity or Hybrid Networks as well.



Lluc Palerm-Serra *joined NSR as an analyst in 2015. His primary areas of focus are Satellite Broadband and Ground Segment covering key growth areas such as new markets unlocked by HTS, opportunities opened by innovations in ground segment, how SatCom integrates in the telecom ecosystem, Enterprise VSAT, Consumer Broadband or Cellular Backhaul. He is the lead author for NSR's VSAT and Broadband Satellite Markets (VBSM) report, industry's unique Commercial Satellite Ground Segment (CSGS) report, and Wireless Backhaul via Satellite (WBS) report. Palerm regularly participates in consulting projects related to demand forecast for new satellite systems, new markets entry strategy or ground segment equipment and services demand for emerging opportunities among others.*

Satellite and Mobile Networks: Partners for the 5G Future

Chris Boyd, Senior Director, Vertical Market Solutions, ST Engineering iDirect

It's projected that soon there will be 6 billion people, 30 billion devices and 50 billion machines online. In this emerging future, essentially everyone and everything will be connected, across every geography. Every application will be supported, from consumer broadband mobile gaming, connected cars, ships, planes, soldiers, and first responders to connected farms and global business networks.

This unwavering demand for connectivity is driving the development of the 5G future. This new networking architecture promises blazingly fast broadband speeds, exponentially higher efficiencies, massive scalability, significantly lower costs for mobile and fixed networks, and ultra-low latency for applications, such as the connected car. It will also support massive machine type communications for machine-to-machine (M2M) and Internet of Things (IoT) applications, some of which haven't even been dreamed up yet.

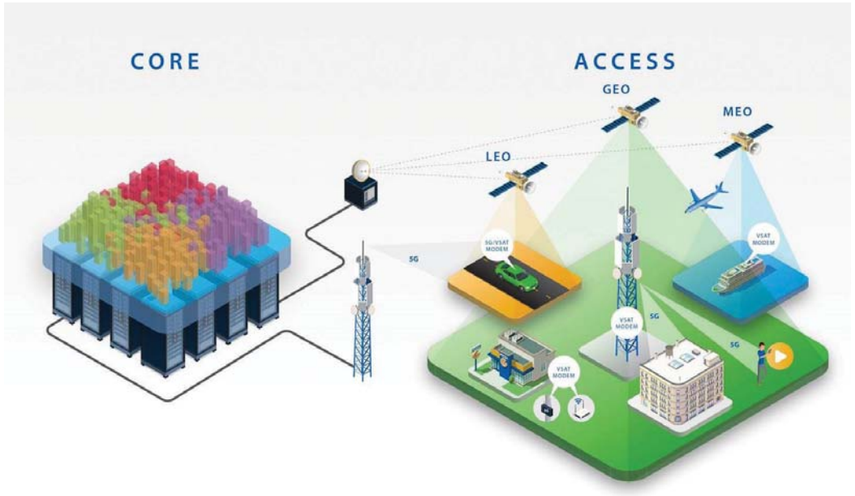
Mobile network operators will emerge as the foundation of this 5G future, satiating our ferocious demand and bringing connectivity to all citizens. According to the 2018 Ericsson Mobility Report, there will be 7.2 billion smartphone subscrip¬tions by 2023. Total data traffic has already shifted from less than 5 exabytes of traffic per month in 2013 to 20 exabytes today. It's projected to hit 107 exabytes by 2023.

However, the growth in demand and the number of devices coming online will present a challenge for mobile network operators. Even with new infrastructure and standards for 5G, the deluge of traffic will put a strain on mobile network operators. Mobile network operators will need assistance to make the connected future a reality, rather than a daydream.

This is where satellite can step up from its traditionally niche role. Satellite's inherent capabilities, strengthened by recent innovations, can help mobile operators face the challenges posed by growing demand. While mobile network operators bring 5G to citizens in urban and populated areas with millimeter wave and small cells, satellite's longer range will bring 5G services broadly to remote areas where building terrestrial networks for enhanced broadband services is simply too cost prohibitive. Satellite will also be able to team up with mobile network operators to offload traffic from terrestrial networks at a large scale using its multicasting/broadcast capabilities for video content offload, mobile edge content caching and real-time mobile video broadcast streaming, preserving high-value wireless spectrum for latency-sensitive services. New applications

will also emerge for markets and use cases such as the connected car, where high-assurance software and firmware updates can be sent to millions of devices simultaneously.

As partners, satellite and terrestrial networks can create the seamless and fully-connected future the world demands.



Building the 5G Future

5G is not simply an improved 4G/LTE standard. Rather, 5G will be built from a whole new network architecture — "a network of networks" — that brings together multiple access technologies, such as Wi-Fi, small cells, and traditional mobile wireless, as well as terrestrial and satellite networks. 5G is being designed by the wireless industry to virtualize, automate, orchestrate, and to streamline service delivery. It brings technology together from three main areas in order to meet the scale for the future: Evolved Packet Core (EPC/5G Core) from the 3rd Generation Partnership Project (3GPP) and the cellular industry; Network Function Virtualization (NFV) and Software Defined Networks (SDN) from the networking industry; and Virtualization and Cloud Computing technologies.

Key Use Cases for the 5G Future

In the 5G future, mobile network operators and satellite will need to work together in old and new use cases to ensure the massive demand for connectivity doesn't overwhelm networks and create a "sometimes-connected" future. A look at a few 5G use cases reveals where satellite will be essential in helping mobile networks provide the connectivity that the 5G future will demand.

Supporting Enhanced Mobile Broadband

Mobile operators will rely on satellite to back them up and drive the next generation of applications that the cellular industry promises to end users, such as faster speed to handsets and opening up fixed wireless connectivity to replace last mile fiber connections to homes and business. Just like with 3G and 4G networks, satellite will play an important role in providing connectivity to remote and mobile sites.

Enhanced mobile broadband scenarios that will require satellite assistance include:

- 5G to Premises: Satellite will complement terrestrial networks, such as broadband connectivity to a home or office in an underserved area, or to enterprise sites as a backup.
- 5G Fixed Backhaul: Satellite will bring broadband connectivity where it is difficult to deploy terrestrial connections in rural and remote areas across a wide geographic region only or best covered by satellite.
- 5G Mobility Backhaul: Satellite will bring broadband connectivity to remotes or user equipment (UEs) on the move, such as airplanes, trains, vehicles or maritime vessels.

Connecting the Internet of Things

5G will accelerate massive M2M connectivity to support IoT, whether that comprises sensors, tracking, surveillance systems or statistics from telematics. In this 5G use case scenario, backhauling from aggregation points is an obvious satellite use case. However, the IoT opportunity will also include providing connectivity at all times, even in remote places. This will be possible due to the decreasing size, weight and power of satellite terminals, coupled with the emergence of phased-array antenna technologies.

Providing Ultra-reliable and Low-latency Communications (URLLC)

While satellite can be considered highly reliable, it will always face some order of magnitude of latency and therefore will not play a direct role in specific ultra-low latency applications, such as providing real-time sensor data for autonomous driving or vehicle-to-everything (V2X) tasks.

However, satellite will be essential to complement these URLLC use cases by pushing out content via multicasting and providing non-critical connectivity to ease congestion.

For example, by using its multicasting capability to distribute content to millions of vehicles, satellite frees up valuable 5G cellular capacity needed for V2X connectivity. In such cases, satellite could be used to distribute software and firmware via over-the-air updates, as well as to provide infotainment to passengers inside a vehicle in a cost-effective way. Moving massive amounts of content over multicast networks to hundreds of thousands of places (or in this case vehicles) at once will continue to be satellite's greatest strength.

Where iDirect Sees the Satellite Opportunity in 5G

Mobile networks and satellite can no longer work in silos. Adapting satellite to operate seamlessly with 5G cellular and terrestrial networks will empower end users anywhere in the world with consistent, reliable, high performance experiences. Service providers will be able to decide how they can best serve customers — whether it's through satellite, terrestrial or mobile networks, or all of them combined. Hybrid use cases of 4G and satellite already exist, but 5G will harmonize them even further by streamlining end-to-end service orchestration and delivery for faster time-to-revenue.

At ST Engineering iDirect, we believe in fostering collaboration between terrestrial and satellite players. To help drive the 5G standard and the adoption of satellite forward, ST Engineering iDirect is fostering collaboration among various ecosystem partners. We also participate in industry standard bodies to ensure that our future solutions are compatible with the evolving 5G standards, and in turn, to make sure the 5G standards properly accommodate the unique value satellite can bring to operators.

Along with a team of consortiums partners (SaT5G, SATis5 and Edgesat), we were the first in 2018 to success-

fully demonstrate live, first-of-its-kind satellite integration into 3GPP network architectures, demonstrating the key benefits of network slicing and SDN/NFV/MEC-enabled 5G construction testbeds. We have also reached several testing milestones which further our innovation in 2019.

We believe in driving the new 5G standards for satellite networks. As a result, we are leveraging principles of Evolved Packet Core (EPC), MEC, SDN, NFV and cloud-based computing into our platform so that it no longer is a separate, standalone network. Rather, it must become an integrated part of the 5G future, appeasing demand and ensuring people globally are connected.

Chris Boyd *is Senior Director of Vertical Market Solutions at ST Engineering iDirect and responsible for driving the overall product and solution strategy across the company's core vertical markets – maritime, aero, telco/enterprise, IoT and defense. Boyd and his team of subject matter experts (SMEs) work closely with key internal and external stakeholders to carefully assess the requirements for each vertical market to develop compelling and competitive products and solutions to address the business needs of our customers and their end users.*

The New DS2000 from Mitsubishi Electric is the next-generation standard satellite platform for commercial communications. Meeting the power needs of multiple transponders with increased power output of up to 25kW, this platform can flexibly respond to diverse applications and perform with reliability backed by decades of development and hundreds of satellite projects worldwide.

eco Changes for a greener tomorrow

MITSUBISHI ELECTRIC
Changes for the Better

Adrian Steckel, CEO, OneWeb

Question

There's been a lot going on at OneWeb in recent months. Can you give us a quick update on how far you've come?

You're right, it has been very busy for OneWeb recently. As you know in February, we successfully launched 6 satellites, that are performing extremely well, and since then we have raised our capital bringing our total to over $3 billion from the help of world class investors and we signed on our first customers.

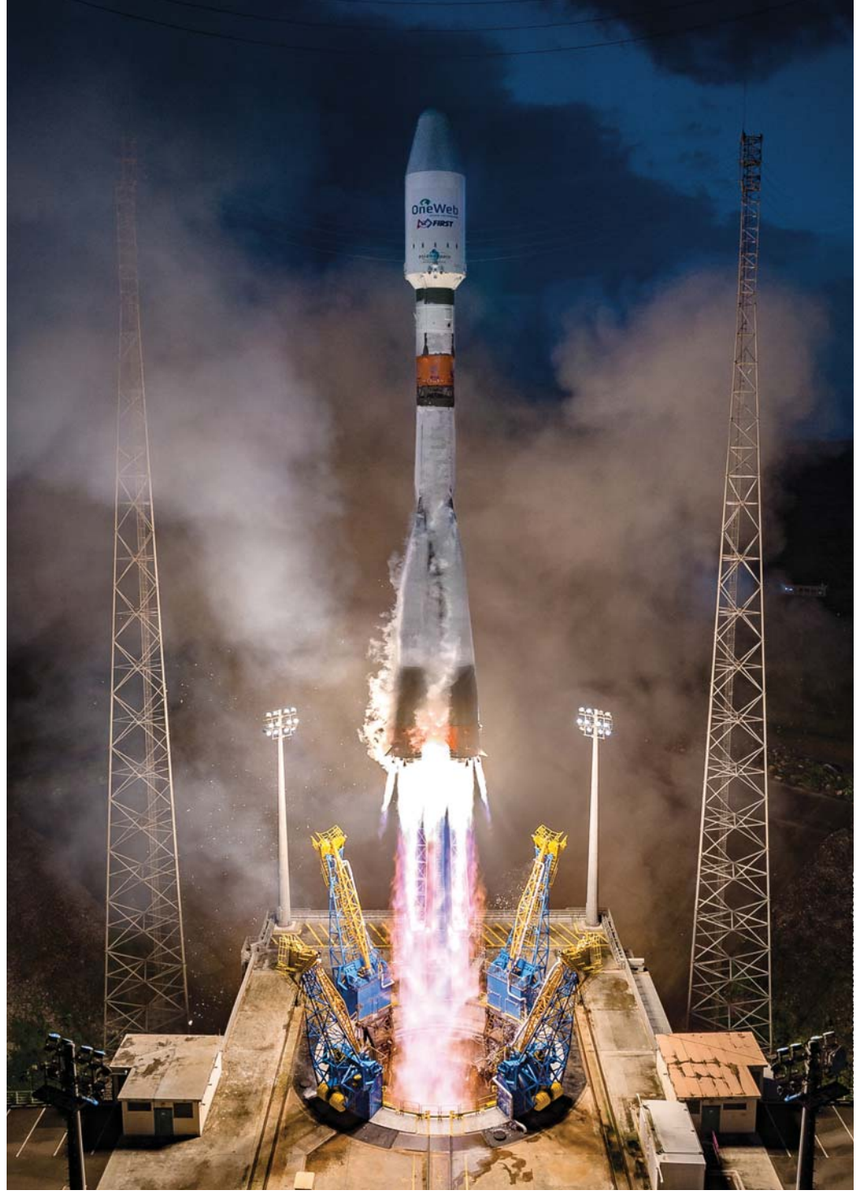
We have opened a second state-of-the-art satellite manufacturing facility that will accelerate our mission and bring jobs to the Florida community. With this new satellite production factory, we will be able to produce 2 satellites a day thanks to our revolutionary manufacturing process – a feat that has never been done before!
We have launched our Responsible Space program which is our commitment to leave no trace in space by ensuring we are good stewards of the natural environment in which we are operating, and last month we streamed a live HD video from space which showcased our low latency, high-speed, seamless connectivity which is 5G ready.

Just this month we have brought our priority spectrum into use ahead of our competition, and we are on track to begin monthly launches starting in December of this year as we look to start partial services in 2020 and deliver global services in 2021.

Question

Why is responsible use of Space important to OneWeb?

Space is a shared natural resource and we want to ensure we protect it for all future generations to be able to access and use it. At OneWeb, we are building the largest global communications network, and we are committed to thus preserving and protecting the environment we work in.



OneWeb's first launch : On February 27, 2019, OneWeb launches the first satellites in its network successfully into space. (Photo: OneWeb)

To achieve this, we made three commitments. First, **responsible design and operational practices** –sustainable business practices are required to support the long-term use of space for all – commercial, educational, and scientific endeavours and we cannot allow it to become polluted.

Developing the space ecosystem is our second commitment because we believe the space industry and its innovative thinking has the potential and ability to develop new technologies that can help protect this resource.

And lastly, **supporting policy outcomes through collaboration**. We and others in our industry have a responsibility to work with governments to develop policies and solutions that can help solve some of the world's most challenging problems.

Question
What makes OneWeb different than its competition?

There are many reasons why we are different from our competitors which is visible in every angle of the company. Our mission first and foremost sets us apart. With half the world still unconnected, and more than 2 million schools unconnected, OneWeb was founded to connect the unconnected. We want to give every person the chance to unlock educational, health, and economic opportunities made possible through the internet. This is a mission shared by our investors, partners, and employees.

Through our joint venture with Airbus, OneWeb Satellites – we have transformed the satellite production process. Thanks to advancements in automation and robotics, we are able to build satellites at a pace and cost previously unimagined before that will change the space and satellite industry for the better.

We maintain a priority spectrum position in the Ku-band and just this past month we met the milestones necessary to bring our Ku and Ka-band spectrum into use and obtain the international recognition from the International Telecommunications Union (ITU). This gives OneWeb an exceptionally strong regulatory position, which allows OneWeb to communicate with devices on Earth.

Lastly, we have an outstanding team of experts and talent driving us forward. The OneWeb Team, our partners, suppliers, and vendors are pushing forward with new innovative technologies and processes that will allow us to build our network effectively, and to harness the full potential of space.

Question
How will OneWeb support the rollout of 5G?

OneWeb will be able to help support the roll out of 5G because our team of experts have made sure that the technology we are building today is ready to adapt to the future. Our advanced and innovative technology was built to be an integral part of the 5G ecosystem and future generations as we look ahead to providing global connectivity for all.

One of the characteristics of our satellites is that they can deliver low latency and high speeds which is crucial and necessary to support 5G backhaul and services. As we assemble our constellation in space, we are ready to deploy worldwide 5G connectivity because all of our cellular generations from 2.5G to 5G are supported by the OneWeb system in the same way.

OneWeb antennas in Svalbard, Norway: Antennas that are part of OneWeb's network are placed around the world to help connect the satellites to the internet. These antennas are located in Svalbard, Norway. (Photo: OneWeb)

Question
What are the key market applications you see for OneWeb?

While we have made great progress to connect people everywhere around the world, we still see almost have half the population still unconnected. Those who are living in rural and remote communities where the terrain is a challenge for fiber to reach, or towns and villages where population densities can be low.

In addition to that we know that as more people travel it is near impossible to have internet access on a plan that matches what we experience on the ground and the same goes for being out at sea.

This means we see a lot of applications and markets our system can solve for. Our satellite network will be at 1,200 km above Earth, and with our satellites so close to Earth we will be able to provide high quality internet connectivity that is high-speed, low latency to people on the ground, in air, and at sea.

We will begin with an initial 650 satellites in Low Earth Orbit that will be able to deliver much needed global connectivity, connecting even the Arctic and from there we will grow to almost 2,000 satellites that can deliver much needed capacity and connectivity to keep pace with the increasing data demands and changing land-

OneWeb's satellite production: Revolutionizing satellite production, the OneWeb and Airbus joint venture called OneWeb Satellites is building satellites at a speed and cost never before possible. Their facility in Florida is building OneWeb's satellites and can build up to two a day. (Photo: OneWeb)

scape as we see IoT and 5G advance.

We are also a B2B. So we are selling our services through the telecom companies, ISPs, and others. Our job is to help bridge the gap where connectivity services do not exist or are inconsistent and we think by working with the companies that are well versed with the community, market, or country needs, we can help address that.

Question

What are the priorities for OneWeb as you look to the end of the year and to next year?

We have several key priorities we are driving forward in the near term.

With our Florida factory now in production and building satellites we are focused on beginning a massive monthly launch campaign that starts at the end of this year and we will now see monthly launches of more than 30 satellites at a time as we build our constellation. Meanwhile, we are continuing to demo our first six satellites, produce our user terminals that will help connect the customer in various markets and making continued progress building out additional ground infrastructure around the world.

And of course, this November will be the World Radiocommunication Conference ("WRC-19") in Sharm-el-Sheik (Egypt), and OneWeb is deeply invested in issues related to the new NGSOs, such as build-out milestones for the bringing into use and constellation deployment, rules for mobility terminals, and keeping the Ka-band spectrum protected and procuring future access to V-band for high-throughput satellite broadband. The build-out milestones are particularly sensitive, as the current ITU rules allow an entire multi-thousand constellation to secure spectrum rights with only a single satellite, which everyone agrees is likely insufficient. The sticking point is how much more time should a large constellation be allowed before the next system in line gets access to that spectrum? Because the longer a constellation holds on to spectrum without fully building out their system, the more that system begins to look like a "paper satellite," and the more the world sees their behaviour as spectrum warehousing, which is anathema to the best practices for orbital/spectrum resource efficiency.

As we look to 2020, we will be conducting demos for many of our customers and starting partial service later in the year with global services ready to launch in 2021. It is an incredibly exciting time for OneWeb and I am excited to be a part of this amazing effort.

Adrian Steckel *is responsible for overseeing OneWeb's growth, long-term strategic development, fundraising, and commercial success. Since 1999, he has been building companies from the ground up and working to enable voice and data communications in countries around the world. Prior to OneWeb, Adrian was the CEO of Iusacell, a successful mobile carrier in Mexico, and he led the buildout of the fiber backbones in both Colombia and Peru. He holds a BA in History from Yale University.*

Why Networking Architecture and Satellite Technology are Key to Powering 5G in Asia

Semir Hassanaly, Market Director, Cellular Backhaul and Trunking, Newtec

As one of the world's most diverse continents, Asia represents a unique challenge when it comes to connectivity. In many ways, the Asian region is at the forefront of technology – better 'connected', more affluent countries such as South Korea, Hong Kong, Singapore, China and Japan are setting the pace ahead of Europe to conquer the 5G world, with China in particular spending $24 billion more than the US on wireless technologies since 2015, according to a Deloitte report, 5G deployment- The Chance To Lead for a Decade. Overall, in their whitepaper, Forecast and Trends, 2017- 2022, CISCO predicts that 62% of Asia's population will be connected by 2020.

However, this leaves 38% of the region without access – a situation which will become increasingly unacceptable as Governments across the world continue to tackle the digital divide with ambitious connectivity targets. Active involvement of less 'connected' countries will reduce e-friction and boost their emerging economy, with the World Economic Forum putting the potential growth at between two and three per cent. Broadband connection will ultimately transform the 'unconnected' in terms of business, government and society – but the right technologies are needed to overcome financial and geographical challenges.

Further adding to the complexity of Asia's digital divide is the exponential growth in overall connectivity which will rely on a medley of technologies including 4G, 5G, Wi-Fi and the Internet of Things (IoT). Early rollouts and the expansion of 5G is further driving this and bringing a new set of challenges for the communications industry. Edge cloud and edge computing for remote connectivity – which will be a powerful catalyst for growth across key IoT markets and all other applications such as connected cars, AI, big data and cloud computing for centralized connectivity – will bring requirements that organizations must adhere to if they are to be competitive. In addition, delivering flexible and agile connectivity for all devices anytime, anywhere, and at an efficient cost will become a must.

As 5G marks a move towards a connectivity landscape characterized by wireless, satellite will be a vital tool in ensuring the 5G world reaches its full potential to provide reliable connectivity and coverage. Alongside this, achieving seamless interoperability with the terrestrial world will be essential.

A New Architecture

With the array of 5G services putting increased pressure on organizations to deliver on diverse performance requirements, the technology will need a new architecture to accommodate it. At the same time, the ubiquity of Internet and cloud computing is growing, further driving organizations to look at overhauling the architecture of their networks.

The common factor here is a distributed architecture which enables service components to be accessed through a remote access protocol. Compared to monolithic and layer-based architectures, distributed architectures can bring a number of advantages to a business' operations. These include improved scalability, better decoupling (where the service is designed without knowing who its consumer is), and better control over development, testing, and deployment. Components within a distributed architecture facilitate change control and maintenance, leading to more modular, responsive and robust applications.

Achieving a Modernized Network with SDN and NFV

As well as service-focused architectures, virtualization technologies are instrumental tools for organizations looking to manage information created by the surge of new data from 5G and other technologies. Virtualization is a key enabler of the 5G future, reducing development costs, increasing quality and accelerating the speed of software deployment or time to market. It also facilitates the use of third-party components, open source and commercially available off-the-shelf hardware and software products.

Software-Defined Networking (SDN) and Network Function Virtualization (NFV) are crucial elements of virtualization and together play a vital role in network flexibility, effectively enabling the 5G future.

SDN is designed to minimize network constraints, increasing flexibility and agility by breaking up the control and forwarding planes. This allows for direct programmable control of the network and for the infrastructure to be abstracted for applications. As needs and demands fluctuate, the traffic flow can be adjusted dynamically and a global view of the network can be maintained by implementing SDN controllers in software. The SDN looks like a single, logical switch to other applications and SDN controllers also use multiple standard procedures and interfaces.

NFV complements SDN by replacing hardware-based network services, such as routers, firewalls, load balancers and WAN optimization devices with virtualized software.
These network services can then run on COTS platforms, reducing costs and allowing scalability through the software flexibility, and can operate on mobile or fixed connectivity. With the advent of 5G, NFV can be utilized to facilitate network slicing, allowing for multiple virtual networks to operate on a shared physical infrastructure and be customized to meet the needs of operators.

NFV orchestrators can further supplement virtualization, allowing network operators to quickly introduce and operate new cloud and NFV-based services while keeping costs under control. Network operators can leverage the service agility, automation and flexibility offered by SDN, NFV, and the cloud as orchestrators allow the intelligent allocation, creation and management of resources, working with heterogeneous systems. This could potentially service a global cloud deployment in different geographical locations and with different providers, managing public clouds and private deployments.

Above The Clouds

Satellite communications are poised to be a cornerstone of the new 5G infrastructure and although high-throughput offerings continue to expand via Geostationary satellites (GEO), Low Earth Orbit (LEO) and Medium Earth Orbit (MEO) satellite constellations are proliferating rapidly. This new wave of satellite communications can fill the connectivity gaps for different applications, bringing lower latency and higher capacity.

These trends in satellite come at an opportune time as 5G gets off the ground and we move towards a landscape dominated by wireless connectivity with major architectural changes accompanying this shift, essentially based on virtualization.

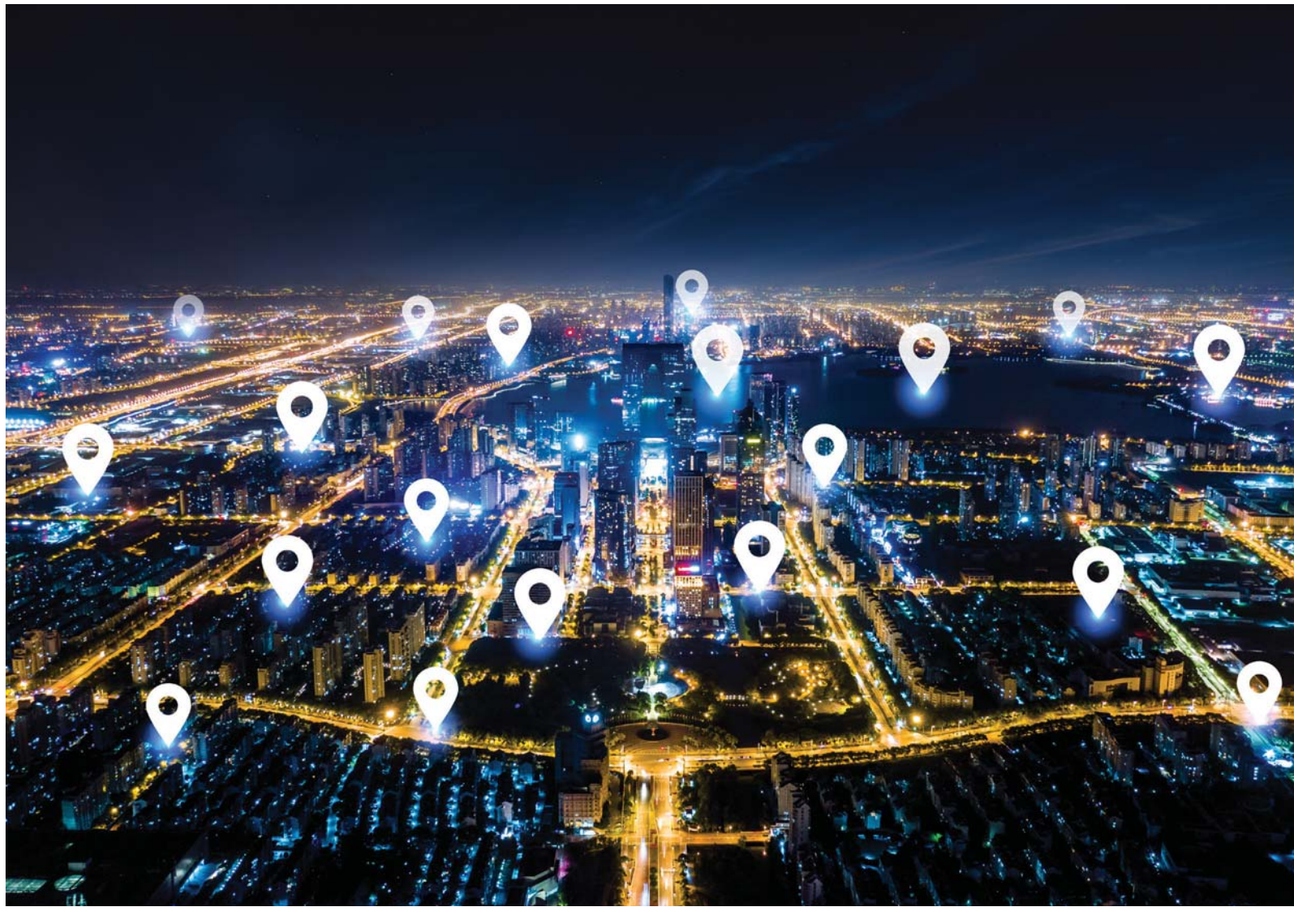
To integrate satellite technology into the overall communication map, service providers will need to provide seamless connectivity between terrestrial and satellite. Traffic will be dynamically steered to the best transport options available according to bandwidth, latency, network conditions and other application-specific requirements. A suite of orchestrators will make this steering decision, also leveraging the 3GPP network slicing. This interworking between terrestrial and satellite is now well recognized and promoted in the 3GPP standards.

This means full integration within the virtualized architecture will also apply to satellite, beginning with the core of the network and then expanding to the edge. Management of the NFV infrastructure will be performed through a Management and Network Orchestration (MANO) framework which will allow easy integration of multiple applications. Some core mobile network functionality could be moved to the edge and a Multi-Access Edge Computing (MEC) platform could host different applications like caching and multicast, which can help reduce latency and improve Quality of Experience (QoE) for the users.

Opening a Dialog

As a leader in the design, development and manufacturing of equipment for satellite communications, Newtec is playing a key role in the evolution to 5G and equipping organizations with the required tools to combine the features of 5G, network architecture and satellite. Our Newtec Dialog multiservice platform implements a service-based architecture leveraging network orchestration, virtualization and management functions, separating the baseband function from the processing (similar to the baseband unit (BBU) and remote radio head (RRH) split in the mobile space) and facilitating the deployment in a cloud environment.

This brings a lower-cost, highly flexible and scalable infrastructure, as well as anytime, anywhere access to a host of services. Customers and service providers will be able to scale services up or down quickly to address changing needs and seamlessly manage the whole solution including new beams and new services. Newtec Dialog also blends with the 3GPP 5G architecture specifications, implementing similar concepts (for example, virtualization), sharing the management functions (for example, MANO), leveraging key features such as slicing and facilitating the seamless interworking between terrestrial and satellite. Of course, the architecture is extended to the remote terminal as well which benefits from the same scalability, flexibility and cost effectiveness features and can also become part of an edge cloud.



A Network for Everyone

This seamless interworking will bring terrestrial networks and satellite together through the architecture space, jointly evolving with them. In Asia, with its diverse landscape, this will be particularly important and play a big part in bridging the digital divide that still exists today, with the satellite element of 5G able to connect hard-to-reach areas never connected before, creating new business opportunities for the industry. A multitude of new applications and services will also be unlocked, propelling a fully connected world underpinned by agility and flexibility.

Semir Hassanaly *is leading the mobile backhaul market at Newtec. A seasoned telecommunications executive, Semir is an expert at bridging technology and business specifically in the Mobile and Internet spaces. Previously with Memotec Semir was vice-president of Marketing & Strategy, and Product Marketing director at Comtech. Prior to this tenure, Semir has launched startups and held several international assignments with Oz Communications (acquired by Nokia), Airwide solutions/Schlumberger & Sema Group in the areas of product management, solutions architecture and product development.*

CYBERSAT19
SECURITY IN CONNECTIVITY
November 6-8, 2019
Reston, VA | Hyatt Regency Reston
The only event of its kind fusing satellite, space, cyber, and government to educate on threat vectors and deliver solutions against next generation attacks.
Save $200 when you register before October 11!
USE PROMO CODE: APSCC
GET STRATEGIC INSIGHTS FROM THESE EXPERTS ON SPACE AND SATELLITE ARCHITECTURE SECURITY.
LIEUTENANT GENERAL ROBERT ASHLEY
Director
Defense Intelligence Agency
RENEE WYNN
CIO
NASA
RON BUSHAR
Vice President and CTO-Government Solutions
FireEye
TERRY HALVORSEN
CIO and EVP IT & Mobile Communications B2G Business
Samsung Electronics
YOU CAN VIEW ALL OF OUR 2019 FEATURED SPEAKERS & GET FULL EVENT DETAILS AT
WWW.CYBERSATSUMMIT.COM

APSCC MEMBERS

Platinum Member

kt sat

SK telecom

Gold Member

ABS

AIRBUS

arianespace
arianeGROUP

HUGHES
An EchoStar Company

INTELSAT
Envision. Connect. Transform.

ILS
International Launch Services

RESHETNEV
COMPANY

KRATOS

MAXAR

Milbank
Space Smart®

MITSUBISHI ELECTRIC
Changes for the Better

MITSUBISHI HEAVY INDUSTRIES, LTD.

Newtec

RSCC Russian Satellite Communications Company

SES

SKY Perfect JSAT Corporation

SPACEX

THAICOM

ThalesAlenia Space

Affiliate Member

ASSI
Asosiasi Satelit Indonesia

avia

ITSO

MSUA

PITA

PTC

SIA

iRG

SSTA
Singapore Space and Technology Association

WTA

Regular Member (Government)

NICTA

Thailand

VTI
Vietnam

Regular Member

AETHERIC ENGINEERING

APSTAR
by APT Satellite

AsiaSat
Reaching Further, Bringing You Closer

BLUE ORIGIN

B-SAT

中国长城工业集团有限公司
CHINA GREAT WALL INDUSTRY CORPORATION

中華電信
Chunghwa Telecom

COBHAM

COMTECH EF DATA

訊連系統國際有限公司
Datacom System International Limited

Euroconsult

eutelsat
communications via satellite

GAPSAT
INTERIM SATELLITE SOLUTIONS

gmv
INNOVATING SOLUTIONS

HISDESAT

Hyundai Marine

inmarsat

INTERSPUTNIK

KARI

MARSH

measat

NSR
NORTHERN SKY RESEARCH

OneWeb
ACCESS FOR EVERYONE

Telkom Indonesia
the world in your hand

satellite evolution asia

Singtel

skyreach

speedcast

Via Satellite

Viasat

ZODIAC DATA SYSTEMS
ZODIAC AEROSPACE

NEW MEMBER

APSCC Welcomes PT Skyreach as a New Regular Member

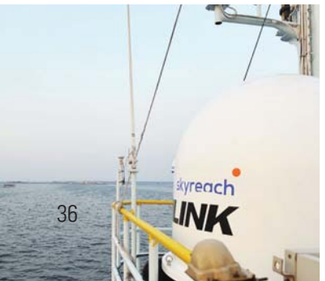
Established in 2012, Skyreach is fastest growth Indonesia Satcom infrastructure & service provider. Since beginning Skyreach has been involved in numbers of large scale VSAT projects with hundreds of installation sites for Indonesia government USO program, plantations, mining, oil & gas, that carried out experience for more than thousand sites scattered all over Indonesia.

Skyreach consistently introduce latest technology to the market for various applications, from compact SNG for broadcasting industry, SatCom on the move, phase array technology that conducted Skyreach involvement in many special projects in the military, special force and other strategic government's projects.

In 2018, Skyreach built Thereach first neutral satellite teleport & datacenter that host domestic and international VSAT/Satellite operator for operating their facilities in Indonesia. This allows operators to interconnect their network independently. Thereach provide customized services from equipment colocation, satellite uplink services, to full managed service that suite to operators need.

Today Skyreach is providing Indonesia maritime industry with one-stop-total-solution. Our complete solution for maritime service includes, Internet/Data, voice, GPS & tracking, IoT and live TV entertainment has made Skyreach become operator who set new standard for Indonesia maritime satcom service.

With culture in conducting our business, equal esteem & reciprocate, has led Skryeach received respected reputation and trust by our customers and vendors in the region.



CALENDAR OF EVENTS

OCTOBER

21-25	**IAC 2019** • Washington DC, USA • www.iac2019.org
29-1	**37th International Communications Satellite Systems Conference (ICSSC)** • Okinawa, Japan • www.kaconf.org/call4papersICSSC.php
30-1	**China Satellite 2019** • Beijing, China • www.china-satellite.org

NOVEMBER

4-6	**Asia Video Summit 2019** • Singapore • https://asiavia.org/insight/events/
5-7	**Global MilSatCom 2019** • London, UK • https://www.smi-online.co.uk/defence/uk/global-milsatcom
19-21	**APSCC 2019 Satellite Conference & Exhibition** • Bangkok, Thailand • http://apsccsat.com
21	**APSCC 2019 Youth Development Workshop** • Bangkok, Thailand • https://apsccsat.com/workshop/
27-28	**Broadband India Forum** • New Delhi, India • www.broadbandindiaforum.com

JANUARY

7-10	**CES - Consumer Electronics Show** • Las Vegas, NV, USA • www.ces.tech
19-22	**PTC'20: Vision2020 and Beyond** • Honolulu, Hawaii, USA • www.ptc.org

FEBRUARY

3-6	**SmallSat Symposium** • Silicon Valley, CA, USA • www.smallsatshow.com
6-7	**GSTC 2020** • Singapore • www.space.org.sg/gstc
11-16	**Singapore Air Show 2020** • Singapore • https://singaporeairshow.com
19-21	**Convergence India 2020** • New Delhi, India • www.convergenceindia.org

PACIFIC TELECOMMUNICATIONS COUNCIL

PTC'20

VISION 2020 AND BEYOND

19-22 JANUARY 2020 | HONOLULU, HAWAII

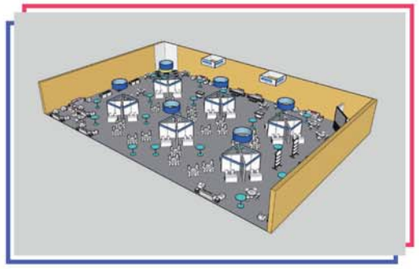
The Pacific Rim's Premier Telecommunications Event

Join more than 7,900 industry attendees in discussing forward-looking views and implications on topics representing the breadth and depth of ICT.

BEST RATES FOR PTC'20: REGISTER BY 31 OCTOBER

REGISTER TODAY AT PTC.ORG/PTC20

What's New



PTC HUB

Showcase your company's new products or services.
Network with ICT industry leaders and build your business.
Give a 10-minute talk or tutorial on a specific topic.

PTC.ORG/PTC20/PTC-HUB

PTC'20 SPONSORS

DIAMOND

RagingWire® DATA CENTERS An NTT Communications Company

PLATINUM

TELSTRA

ADVERTISERS' INDEX

APSCC Officers

PRESIDENT

Gregg Daffner
GAPSAT

BOARD OF DIRECTORS

Patrick French
ABS

Huang Baozhong
APT Satellite Company Ltd.

Vivian Quenet
Arianespace

Eddie Kato
HISe

Kevin Reyes
ILS

Terry Bleakley
Intelsat

SY Paik
KTSAT

Daryl Mossman
MAXAR Technologies

Yau Chyong Lim
MEASAT

Hiroshi Koyama
Mitsubishi Electric Corporation

Dani Indra
Pasifik Satelit Nusantara

Kevin Seow
SES

Ng Kheng Ghee
SingTel

Mitsutoshi Akao
SKY Perfect JSAT

Tom Ochinero
SpaceX

VICE PRESIDENTS

Patrick Wong
Comtech EF Data

Tare Brisibe
SES

APSCC Newsletter - A Great Way to Advertise

With a vast international circulation that includes the most prominent members of the satellite, space and communications communities, APSCC Newsletter is seen by an elite readership of industry professionals around the Asia-Pacific and globally.

Your message will reach the right people. Advertising in APSCC Newsletter is a cost-effective way to reach your potential clients and business partners. APSCC Newsletter can bring your company to the attention of key personnel in the satellite and space technologies, telecommunications and broadcasting industries. We offer you exclusive contact with people in the government, academic and industry sectors.

3rd Quarter 2019

Advertiser	Page
Arianespace	Inside front cover
China Satcom	02
Hughes	05
ILS	11
Thales Alenia Space	17
Mitsubishi Electric	21
Newtec	27
CyberSat19	33
Smallsat Symposium 2020	37
PTC'20	39
KTSAT	Inside back cover

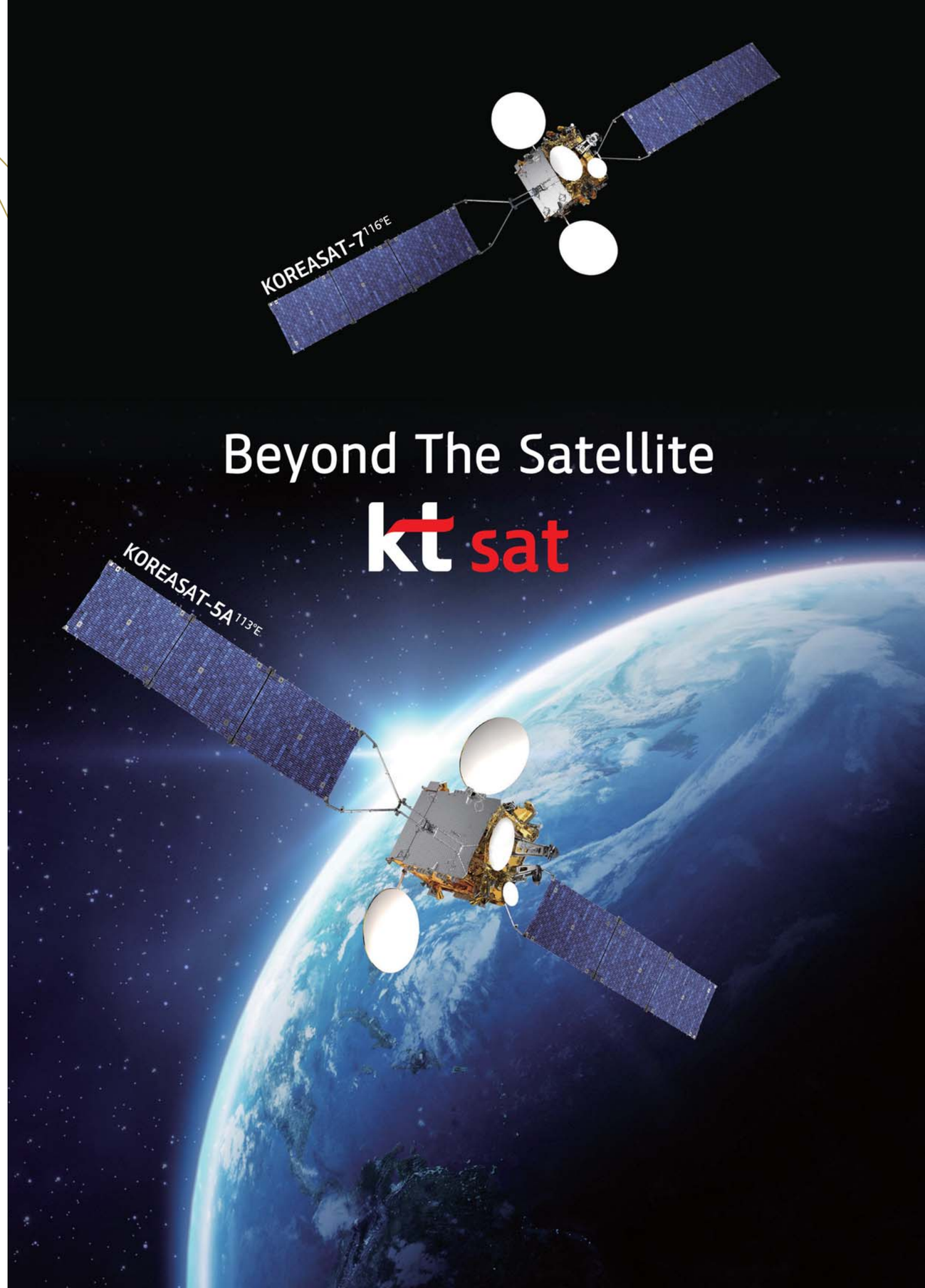
APSCC is a non-profit, international regional association representing all sectors of satellite and space related industries. APSCC membership is open to any government body, public and private organization, association, or corporation that is involved in satellite services, broadcasting, manufacturing, launch services, risk management or associate fields such as datacasting, informatics, multi-media, telecommunications, and other outer space-related activities with interests in the Asia-Pacific region.

APSCC aims to exchange views and ideas on technologies, systems, policies and outer space activities in general along with satellite communications including broadcasting for the betterment of the Asia-Pacific region. Conferences, forums, workshops, summits, symposiums, and exhibitions are organized through regional coordination in order to discuss issues that affect the industries and to promote and accelerate the efficient introduction of outer space activities, new services and businesses via satellites.

In order to disseminate industry related information, APSCC publishes a quarterly satellite magazine as well as a monthly e-newsletter, which are distributed worldwide to members and others. The quarterly magazine and other publications are available on the Web at www.apscc.or.kr.

Editorials and Inquiries

Inho Seo, Editor
Asia-Pacific Satellite Communications Council
T-1602, 170 Seohyeon-ro Bundang-gu, Seongnam-si, Gyeonggi-do 13590 Rep. of KOREA
Tel: +82-31-783-6247 / Fax: +82-31-783-6249 / E-mail: editor@apscc.or.kr / Website: www.apscc.or.kr

APSCC Newsletter is a publication of the Asia-Pacific Satellite Communications Council. It is published quarterly in March, June, September and December. The contents of this publication may not be reproduced, either in whole or in part without, prior written permission from the editor. The views and opinions expressed are those of the authors and are not necessarily supported by APSCC.

Design and Printing by Design CRETA
Tel: +82-2-454-2022 / Fax: +82-2-458-1331 / Website: www.designcreta.com