

The success of satcom's redefinition lies in the ground segment ●●

The satellite industry is evolving within a wider telecoms ecosystem that is advancing at a rapid pace. Applications across every industry and end users globally are demanding more as technology advances and networks become more capable.

Frederik Simoens, CTO at ST Engineering iDirect

Satellite was once treated as a network option for the last mile in cases where terrestrial networks were too expensive or physically not feasible. The industry has come a long way and satellite is on the cusp of establishing itself as a more than capable alternative or complementary technology to terrestrial.

To take this leap, two ecosystems and their transformations need to be acknowledged. As an industry, we need to understand the changes that are occurring with respect to 5G and NewSpace to accelerate and facilitate a successful transition and to ensure that satellite takes its place as an integral part of the new connectivity landscape.

CRITICAL ENABLERS: VIRTUALIZATION, ORCHESTRATION, AND STANDARDIZATION

NewSpace, specifically, is the evolution from GEO satellites to a hybrid mix of GEO, LEO and MEO orbits. This shift means the development of constellations of small satellites that are software defined and dynamic, offering new possibilities and greater flexibility.

At the same time, the telco industry also is adopting critical advances in virtualization and cloudification to improve the speed, scale, cost, and flexibility of service delivery. It's crucial that the satellite industry acknowledges and understands the implications of these changes and the importance of embracing them in the context of unlocking the potential of NewSpace.

Virtualization and the cloud can reduce the operational complexities, make integration easier, and empower satellite networks with the ability to deal with increasing demands from end users by providing scalability and flexibility. In order to shift the infrastructure to the cloud, the ground segment needs to embrace virtualization and standardization technologies to move satcom processes away from the hardware dependencies to better integrate with the terrestrial 5G networks. The cloudification of the



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ground network will add degrees of flexibility so that it can scale up and down, just like the satellites, and have the capability to move bandwidth around as required.

That network must then be able to integrate with the overall ecosystem, end-to-end. The use of standards will allow service providers to integrate satellite communication systems into an existing terrestrial environment that can be easily managed as one, further aligning the operations. This will come through adoption of the same telco 3GPP and MEF standards and utilizing service orchestration standards. Orchestration, and embracing Artificial Intelligence (AI) and Machine Learning (ML), can help networks automate functions and tasks for complex enterprise networks. Networking and orchestration technologies need to work in unison across multi-orbit satellite, terrestrial and mobile networks to enable a truly seamless service offering. Orchestration can achieve exactly that as it matches software-defined satellite constellations with software-defined networks.

Thanks to seamless integration alongside terrestrial networks, satellite can play a more prominent role in hybrid networks and address additional use cases which translates to new revenue streams and business growth.

COLLABORATION AND PARTNERSHIPS WILL BE KEY

This new connectivity landscape, the network of the future, will not be achieved without collaboration within and outside of the satellite industry itself. Involvement with industry standards groups to ensure that new technological concepts and developments align and that each are educated on the nuances of the different environments is an important step that should not be underestimated.

The New Ground initiative serves to highlight the key role that the ground segment will play in the industry transformation. This will only be achieved through unique ideas, transformative technologies and impactful industry collaboration. This is far bigger than any one company and will take dedication and participation between the satellite industry, Telco entities, and terrestrial standards organizations such as 5G MAG, MEF, and 3GPP to make it happen. Securing a place at the table with these groups is essential to drive home the importance of satellite in future connectivity networks.

3 Ecosystems are Converging Today



Converging Ecosystems. Photo courtesy ST Engineering iDirect ●●●

Over the last few years several consortiums have formed with the aim of validating satellite's integration into a 5G core network such as Sat5G, Satis5 and Osmosis. ST Engineering iDirect has been working with these consortia and participating directly in the 3GPP standards initiative ensuring that, as our industry adopts the standards defined by 5G, it is optimized for satellite communications.

TECHNOLOGY MILESTONES

As previously mentioned, the critical first step to the integration of satellite technology into the new connectivity landscape lies in the virtualization of hardware, something that is currently being embraced at ST Engineering iDirect. We are shifting from ground segment-based hub hardware towards infrastructure virtualization and the cloud to ultimately allow our customers to scale faster without the need for additional cap-ex investments.

We have entered into a partnership with Microsoft Azure Space to develop virtualized modem capabilities and have been working towards the first phase in the development of a virtualized modem that can be deployed on a Microsoft Azure-based cloud solution. A successful demonstration of the demodulation of an iDirect virtualized high-speed modem running as software on a server located in the Azure Cloud has already been achieved. Now, instead of satellite communications relying on physical hardware stored at the ground level, it can utilize software that is stored in the cloud to transmit data.

The satellite industry can work in unison with cloud Service Providers and embrace virtualization technologies to carry out the modulation and processing of the satcom infrastructure. Steps to achieve that include the abstraction of the software functionality from the hardware and the adoption of standardized interfaces for easier interoperability of virtualized components in the cloud.

To that end we jointly started an open collaboration with ecosystem partners through the Digital IF Interoperability Consortium (DIFI) to define the Digitized Interface between modulator/ demodulator, modem, and RF components as a standard. Here, we have played a

major role within the consortium which comprises ground segment players seeking to establish an open standard for the SATCOM industry. The consortium made good progress in 2022 and released an updated version of its interoperability standard in August. This improved the maturity of the specification and was part of the group's goals for 2022 after it released version 1.0 last year. In 2023, it will continue to seek further adoption and incremental improvement of the standard.

In 2022 we already showcased the adoption of the DIFI standard in a virtualized SCPC modem in the Microsoft Azure Cloud. In this demonstration we showed how our virtualized modem used a digital IF interface instead of the analog L-Band interface. In 2023 we are demonstrating the ability to incorporate the DIFI standard into our baseband technology connecting our modem and hub baseband with the RF equipment.

Digitizing the interface between modem and RF components using the new open standard, allows us to leverage the latest virtualization, cloud computing and network function virtualization technologies as well as greatly improve the performance and scale of satellite hub, gateway, and modem equipment.

FOR THE BETTERMENT OF THE OVERALL CONNECTIVITY LANDSCAPE

It's clear that the pace of innovation in space and on the ground will need to work in parallel. This is not only for the benefit of the satellite industry, but also for the betterment of the overall connectivity landscape. Satellite has unique qualities that mean it can accelerate the availability of quality networks to users with the help of virtualization, standards and cloudification.

As ground segment providers, we have to play the role of unifiers – the ones who will enable the changes that we are seeing in space and with the advent of 5G. This change is not going to happen overnight and will require the innovation, collaboration, and work of the whole industry. But we are on the path to transformation, driving this change for our customers to enable agile, flexible connectivity anywhere. ●