Koen Willems, VP EU Programs and Government Relations, ST Engineering iDirect

GMC Q&A

Addressing the challenges of MilSatCom networks

The communications and connectivity requirements of governments and militaries are rapidly evolving. ST Engineering iDirect has developed a novel approach that enables users to manage increasingly complex SATCOM networks. We spoke with Koen Willems, the company's VP EU Programs and Government Relations, to get the details.

Crispin Littlehales, Executive Editor, Satellite Evolution Group

Question: When it comes to satellite communications, the needs of both the government and defense sectors have become increasingly complex. What are you seeing as the key challenges?

Koen Willems: In recent years, the government and defense sector has seen some significant changes in terms of its communications and connectivity requirements. There has been an increased complexity of ground segment satellite networks. In addition, a large number of constellations are being launched, in multiple orbits, with more sophisticated satellites and more On-the-Move/On-the-Pause applications—and there's a need to deploy them on a global scale.

There's also been the convergence of networks, integrating different access technologies and preparing the ground for 5G. This is all happening against a backdrop of an increased amount of multi-domain security threats, especially cyber and electronic warfare, and a lack of Suitably Qualified and Experienced Personnel (SQEP). Not all government and military entities have the knowledgebase, experience, or resources to manage these increasingly complex SATCOM networks and often partner with other nations for satcom. This is especially true of smaller nations.

Question: What is ST Engineering iDirect doing to address these challenges?

Koen Willems: At ST Engineering iDirect, we have recognized this evolution in requirements and have responded by developing a new approach which we call Resilient Integrated Solutions or RIS. This is a complete end-to-end MilSatCom solution that can be tailored to specific needs. We can leverage our vast ecosystem of best-in-class partners to be the one-stop shop for baseband equipment as well as other supporting services and innovative capabilities.

There are seven principal benefits that this new approach brings to government and military users:

- **One-stop-shop** offering ground segment technology and services ranging from baseband to terminals, gateways, and (hybrid) satcom solutions for military end-users.

- Embracing the complexity of MilSatCom networks with **innovative technologies** and **as-a-service offering** allowing military end-users to focus on their core tasks.
- Increasing security and resiliency of MilSatCom networks through a **multi-layered security & resiliency** approach.
- **Integration services** expertise to install, operate and maintain end-to-end (hybrid) MilSatCom networks.
- Design and productization of **secure waveforms** and adjacent **baseband and network elements.**
- **Seamless connectivity** by supporting next-gen MilSatCom global networks and **multi-orbit** assets addressing multiple dispersed theatres of operation on land/sea/air.
- Agility through **fully integrated terminals, gateways, and antenna systems** in orchestration with baseband and networking technologies.

Question: Resilient Integrated Solutions (RIS) includes your baseband equipment for MilSatCom Networks along with your Evolution Defense platform. Can you drill down and provide some technical details?

Koen Willems: RIS is built upon the foundation of the Evolution Defense platform which features the highest levels of security, resiliency, agility, performance, network optimization and encryption, remote commissioning, and network monitoring. RIS also features terminals, antennas, gateways and RF elements to provide secure communications and information assurance. This includes manpacks and mobile earth stations and an extensive range of RF products, terminal and gateway technologies and integration services.

We know how critical security is to our customers and we have developed Multi-Layered Security to build layers of defense to detect, mitigate, prevent, and predict threats as well as network layers for resiliency to switch between networks when interference or jamming arises.

This includes a network management system, spectrum monitoring, and geolocation services that can identify potential threats; signal excision technology and network diversity to ensure persistent communications; transmission security (TRANSEC) and information assurance capabilities that ensure systems remain secure. Through enabling evaluation of current and historical data, the RIS suite of technologies also supports prediction of future interferences and threats.

For mission-critical communications, a PACE approach (Primary, Alternate, Contingency, Emergency) for redundant means of communications can be achieved by leveraging hybrid networks from satellite communications to terrestrial such as the Unified Communications System (UCS). The UCS is a fully IP-based radio communications system that provides secure, reliable multi-media communications by connecting classic radios to mobile smartphones to leverage common apps for situational awareness, quick-to-deploy tactical, or connect workgroups with a mobile command post. The UCS network and gateway diversity, waveform innovation, and next-generation terminals are all elements that can be integrated into the PACE approach.

Question: There is a lot happening in space with the launch of thousands of satellites across all orbits along with the convergence of the telecom ecosystem. What do governments and military need to do on the ground to take advantage of all these new satellite capabilities and innovations?

Koen Willems: We are already starting to see the launch of multi-orbit satellite constellations and this trend is set to continue. Over the next five to ten years, these constellations will be up and running with new flexible payloads that can be launched and configured later to a specific use case or reconfigured depending on demand. But, to unlock the capabilities that NewSpace offers, ground systems must be equally dynamic and tightly integrated to dynamically allocate space resources as and where they are needed.

If we combine this with what's happening in the telco arena with the rollout of 5G, this is sending us in a new direction and the ground segment has to do one clear thing: make life easy for the end user. This means eliminating the complexity and ensuring a high-quality, secure end user experience. This is a complex technological move forward. The ground segment will deliver an absolutely seamless user experience for the user so that it doesn't matter which satellite they are using, whether it's a GEO, MEO or LEO satellite, and whether they move from one orbit to another – it just happens. And it happens on one platform and at the lowest possible TCO.

It will be critical for the government and defense sector to have the right technology partners in place to enable them to address these requirements. With over 35 years of ground segment innovation, we are the market leader in the government/

defense, enterprise, mobility, and broadband markets. Our best-of-breed technology, equipment, and services work in orchestration to achieve seamless connectivity and information assurance that is critical for government and defense users.

Question: What are the challenges that must be overcome by ground segment providers to make New Space capabilities a success?

Koen Willems: The changes going on in space encompass a lot of new elements, new capabilities, and new innovations. It's extremely important that our industry now figures out how we take advantage of this. Satellites now have terabit levels of capacity. New LEO constellations with hundreds and even thousands of high-capacity satellites form a network together. That's where orchestration of capacity resources and synchronization with the ground segment becomes critical. Satellites are becoming more capable. Whilst they used to be static, with an unmoving beam and custom built to serve regions and applications, today they feature standardized, fully programmable, and fully digitized payloads.

As the ground segment industry, we need to ensure that the innovation is in place to tightly integrate space and ground to realize these capabilities. This will be achieved by enabling networking and orchestration technologies to work in unison across multi-orbit satellite, terrestrial, and mobile networks to enable truly seamless service. We call this a multi-access, multi-orbit, multi-service platform. This orchestration will allow access over LEO, MEO, GEO, and terrestrial links to provide more flexibility and higher scalability.

We will also need to implement standards which will enable us to interoperate and virtualize the ground segment. For example, we are heavily engaged with DIFI (Digital IF Interoperability Consortium) which plays an important part of the interoperability challenge when it comes to virtualizing modem technology. However, there are many other aspects to interoperability. The integration of satellite networks with terrestrial networks, for instance, requires interoperability at the management and orchestration layer. Here, the standardization work being done within 3GPP is very promising. Again, standardization on how these different components should interface is currently being examined.

Another area is space/ground convergence. We've just announced a strategic partnership with satellite manufacturer Airbus Defence and Space to enable tighter space-to-ground integration and promote technology and vision for the future. Both our companies will draw on our long history of collaboration, experience, and proven technology to focus on areas of innovation that will benefit satellite operators' time-to-market. Areas of focus will include the fully digitized Onesat GEO satellites; NGSO constellation programs; the identification of existing and emerging use cases; the corresponding end-to-end solution architecture and future standards. We have already collaborated with Airbus on ESA's Free Hopper project, which aims to validate the technical maturity of advanced DVB-S2X beam-hopping using the DVB-S2X standard for large European initiatives. This is a great way to advance our relationship for the benefit of our customers.

Question: How do you see all of this unfolding and how long do you think it will take?

Koen Willems: This will not happen overnight. There are many different things that need to align. Ground systems must push towards a standardized, cloud-based service delivery that is driven by three key technology enablers: orchestration, standardization, and virtualization.

At ST Engineering iDirect, we have been working towards this for some time and have been engaged in key Proof of Concept demonstrations.

The first is the virtualization of our modem with Microsoft Azure virtualization and cloudification for faster scale.

The migration towards virtualization and the cloud is taking place across every industry and every region as businesses look to accommodate the surge in bandwidth demands. At ST Engineering iDirect, we are also starting to move away from ground segment-based hub hardware towards infrastructure virtualization and the cloud. This will ultimately allow our customers to scale faster without the need for additional cap-ex investments. Virtualization and cloudification will reduce overall operational complexity, enabling a fully digitalized ground network that can integrate within the telecom 5G fabric and provide access to cloud-based applications and management tools as well as improved performance and security.

In order to interoperate easily and to run in the cloud, satellite modems also need to become software defined. To enable that, we are currently working on the abstraction of the software modem functionality from the hardware. We entered into a partnership with Microsoft Azure Space to develop a virtualized modem that can be deployed on a Microsoft Azure HCI Stack based solution. Last year at World Satellite Business Week in September we announced the successful demonstration of a

highspeed virtualized SCPC demod capability by running it on commercial off-the-shelf hardware in the Microsoft Azure cloud. This demonstration also showcased the use of a digital DiFi RF interface instead of the traditional L-Band interface. In March 2023 we showcased the virtualized modulator capability, our second Proof of Concept (PoC) with Microsoft.

Our second PoC was with the DIFI standard. This demonstrated the interoperability of modems and Wavestream BUCs via a digital interface. This PoC implementation of the DIFI standard is an important milestone on our path to virtualization and the realization of the all-digital teleport. Our products with DIFI-compliant interfaces will simplify gateway designs and pave the way for a more flexible and fully virtualized ground infrastructure.

Our third Proof of Concept is on 5G core network integration. Until now, Satellite VSAT systems have been managed as standalone systems. Today, this is changing as some of the terrestrial standards are becoming dominant, such as the 5G/ 3GPP and the MEF standards. 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. To help drive the 5G standard and the adoption of satellite forward, we are fostering collaboration among various ecosystem partners and participating in industry standards bodies. Along with a team of consortium partners (iNGENIOUS, SaT5G, SATis5 and OSMOSIS), we have been demonstrating 5G capabilities over satellite for a number of years. For example, we were the first to successfully demonstrate live, first-of-its- kind satellite integration into 3GPP network architectures.

With our partners, the iNGENIOUS Consortium, we have demonstrated a 5G Maritime IoT use case whereby we have successfully backhauled IoT sensor data being tracked from a shipping container on land and at sea over satellite to the cloud using a 5G Core. In this scenario, our modem behaves like a 5G UE to the integrated 5G core network and is being routed, controlled, and registered through the 5G Core GUI. Please watch this video https://satelliteevo.com/hwz to find out more.

We'll continue to build on this work to achieve the ultimate goal of enabling the benefits of New Space to become reality here on the ground through technological innovation and collaboration. **GMC**

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