



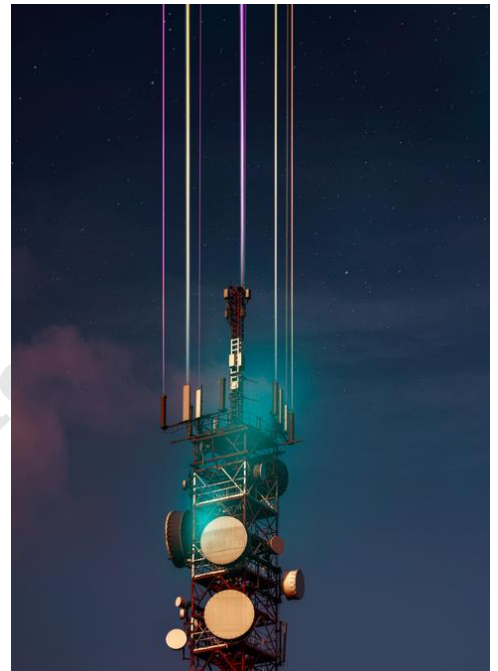
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Transforming Satcom: How Digitization is Delivering New Opportunities

By: [Helen Weedon](#)

Thanks to an ongoing digital revolution, there are new opportunities opening up to the long-established industry that is satcom. At every point of the satcom workflow, technology is adapting to the demands of a modern market. Satcom brings unique communication capabilities that can benefit customers; wide-reaching coverage without need for terrestrial infrastructure, the low-latency of Low Earth Orbit (LEO), the resilience and bandwidth of Geostationary Earth Orbit (GEO), and all while becoming more economically competitive. Facilitating this change has seen the industry take huge steps through innovation, with its digital transformation driving much of the progress. So, what has this unlocked within the industry? And what are the real benefits to customers? In this article I speak with our members to explore the real impact of satcom's digital revolution.



Satcom's New Position Within the Communications Ecosystem

Satcom has undoubtedly gone through a big shift in recent years. The demand for data has seen new entrants to the industry launching LEO into mainstream markets. This shift has had a significant impact on ground technology and has accelerated the virtualization of the industry. Kevin Tobias, Senior Director of Product Management, Kratos explains, "The space segment in the satcom industry has been disrupted by new entrants and this is driving the ground segment to become more flexible, agile and cost-effective. Virtualization is key to making the ground system move from just being infrastructure to becoming a competitive advantage and drive more business impact. Virtualization modernizes the ground system to become software-defined and enables the satellite industry to become much more like the more advanced telecom and IT networks."

Reflecting this perspective, Simon Swift, Engineering Director, ETL Systems notes, “We believe that digital transformation is the next important stage in satcom evolution. As our requirement for bandwidth increases, the need to extend beyond L-band Intermediate Frequency has become clear, particularly with the bandwidths of Ka Band, and particularly, the emerging Q/V band operation.”

As we see the industry shift to serve the market’s demand for data, it is no longer operating in an environment where telcos, terrestrial and satcom are siloed. Erwin Greilinger, Product Line & Sales Manager, Eviden explains, “Satcom is no longer isolated. It’s becoming part of hybrid, multi-orbit, multi-network ecosystems. See for example partnerships between satellite operators and cloud providers like Amazon Web Services, Microsoft (Azure Space), and Google. Satcom becomes a seamless extension of terrestrial 5G and enterprise IT infrastructure aligning with telecom industry standards rather than a niche connectivity solution.” He adds: “Virtualized ground systems and software-defined payloads allow operators to offer satellite as a service by applying dynamic higher margin service models, like on-demand bandwidth, temporary capacity boosts in case of events, disaster response or pay-as-you-go models. Virtualization enables unification of GEO, Medium Earth Orbit (MEO), and LEO networks and integrates capacity with terrestrial 5G under one orchestration framework.”

Serving Fresh Benefits to Customers

Beyond network coordination and delivery of capacity to users, the digital transformation of satcom is delivering direct benefits to customers. Greilinger explains: “Decoupling software from proprietary hardware — both in space and on the ground – reduces OPEX (higher level of automation and orchestration) and CAPEX (lower hardware costs), allowing our customers for more global expansion without proportional infrastructure growth.” Swift concurs: “The separation of digitization from the modem allows a considerable improvement in the flexibility of system deployment, including the ability to stand-up additional modem resource as required, and to seamlessly upgrade to new technologies.”

This benefit relieves a significant pain-point that has long been associated with satcom; the high cost of infrastructure. The removal of this barrier allows the sector to deliver new opportunities to customers, enabling them to both scale up at a vastly reduced financial risk, and build resilience through robust, multi-layer networks. Tobias adds: “Customers especially in government are looking for agile and resilient network architectures to support a range of missions.”

The improved workflows offered by digital transformation have a real impact on customer operations. Tobias explains: “Some larger customers are looking to simplify and streamline operations across multiple domains required to operate a service or mission. For example, spectral monitoring, Telemetry, Tracking, and Command (TTC); Command and Control (C2), and Satcom can all be hosted on a single platform instead of a range of systems.” This demonstrates how satcom is improving its accessibility, both through cost reductions and operational efficiency. He adds: “Virtualization has other benefits. Services can be delivered much faster virtually - they can be automated and orchestrated easily meaning a faster time

to market. Additionally, virtualizing infrastructure means that it can be shared across missions, meaning that resource utilization can be maximized.”

On workflows, Swift states: “The flexibility of distribution of IP signal data improves system resilience, due to significantly easier routing possibilities. It should be noted that this aligns more closely with the more IT based engineering graduate output entering the employment market.”

Swift highlights another key benefit offered by ground segment virtualization: signal efficiency. “Signal quality improvements due to the management of signal degradation at the front-end of the distribution system enables greater transmission distance without the losses associated with fiber transmission.”

Delivering a Standardized Approach to Satcom

Understandably, interoperability has been a significant focus for the industry. Creating an interoperable landscape expands its potential. Tobias explains, “Virtualizing makes the satellite network much more standardized and easier to manage. For example, the increased interoperability streamlines operations by supporting multiple waveforms that can be more easily managed in a single system.” Swift explains the important role standards have to play when manufacturing and sourcing equipment to create these networks: “Just as the L-band Intermediate Frequency (IF) made for inherent interoperability, the standardization brought by the Digital Intermediate Frequency Interoperability (DIFI) consortium plays a key role in ensuring that there is a wide ranging ecosystem of compatible digital products available to the customer, driving competition in the market.”

The mission of the DIFI consortium is to enable the digital transformation of space, satellite, and related industries by providing a simple, open, interoperable Digital IF/RF standard that replaces the natural interoperability of analogue IF signals and helps prevent vendor lock-in.

The Latest Innovation: The Latest Tools Enhancing Satcom

Innovative solutions have come from the technological surge caused by the digital transformation. This innovation demonstrates the advantages virtualized networks deliver to users, enabling flexibility and resilience to networks. Tobias shares: “The Kratos OpenSpace Platform is a fully virtualized, software-defined ground system that supports the Digital Video Broadcasting - Satellite Second Generation Extension (DVB-S2X) waveform for satellite communications, enabling high-speed, flexible, and automated operations over GEO/MEO links. Kratos and partner Radisys announced the development of a satellite base station – a 5G Non-Terrestrial Network (NTN) gNodeB — delivered completely as cloud-native software, to be deployed as part of the OpenSpace system. This new solution is completely different from traditional hardware-based options for ground systems. It will enable open, highly scalable high-performance 5G service delivery through any 5G core network worldwide.”

Swift explains ETL Systems’ latest focus: “Until recently, the market has focused on gateway digitization. ETL is in the process of releasing its latest digitizer, which brings all of the

benefits of gateway digitization to the system edge, whether considering the edge as an individual terminal where there are significant benefits in SWaP, or as a small gateway. These digitizers are initially available as a fully environmentally sealed Outdoor Unit (ODU), equipped to survive the rigors of field operation; and as an OEM embeddable module, which can be embedded either into antennas, or, with its low profile, into 1U 19" racks."

Greilinger highlights: "Eviden has enhanced its Satellite Monitoring product SkyMon with a scalable automated system to monitor software defined radio satellites based on a future proofed microservice architecture. It continuously monitors bandwidth, modulation and coding variations across beams and generates alarms when deviations from operational plans occur, enabling customers for rapid corrective actions. Furthermore, it provides capabilities to verify if beam hopping sequences are executed by the satellite as planned to ensure that users receive the right capacity at the time when demanded. SkyMon ensures full transparency and operational confidence in this highly dynamic payload mode."

The Future: Where Can We Expect Satcom to Sit in 5 Years?

With so much change having occurred in satcom in recent years, attention is turning to what the future communications network will look like. Greilinger believes that virtualization will be at the core of future satcom: "Virtualized ground segments will become standard. Teleports will be more distributed and centrally software controlled. AI will dynamically rout traffic based on user demands, latency and available data rates using GEO/MEO and LEO capacity. Satcom will be fully integrated with terrestrial networks. The type of communication channel (satcom or terrestrial) will be completely transparent to users."

Tobias concurs, adding: "We see virtualization becoming much more mainstream in the satcom industry. The approach has been adopted and proven in the EO industry by providers such as KSAT, AWS and Atlas Space Operations. It is also being embraced by the government for a range of missions. It is the path that is critical to making the satcom industry compete more effectively and to reach new markets by integrating with telecom networks natively."

Swift adds: "Once a signal is in the digital domain, with a precise timestamp, many forms of additional processing can be undertaken. Such signal processing may include signal enhancements through receive combining, interference cancellation, monitoring and geolocation. Consider the iPhone when first launched. The plethora of apps now available was unimaginable at the time. In five years' time, numerous digital building blocks will be available to further enhance signal quality and utility."

Underpinning Satcom's Potential

Virtualization is simplifying operations across the workflow and enabling the satcom industry to slot into the wider communications networks, opening it up to new customers and new use cases. This delivers real benefits to users; flexibility, scalability, and resilience, enabling users to develop comprehensive networks built upon the technology. By allowing

users to holistically access the catalogue of satcom's capabilities intelligently and easily, it is unlocking its potential and driving growth within the industry.

This growth is built upon its digital transformation; without it, multi-orbit, multi-networks capabilities would be impossible. Virtualization has unlocked satcom's potential and is set to continue to drive its success.

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