



**EMBRACING THE CLOUD  
IN HYBRID NETWORKS**

Enterprises all over the world are joining the cloud revolution and moving their vital operations and IT infrastructure to the cloud—a trend that has increased in recent years and that shows no signs of slowing down. This development has major implications for the satellite industry: To keep pace and stay relevant and useful to enterprise clients both present and future networking infrastructure needs to migrate to the cloud. By embracing this shift, the satellite industry can create enormous opportunity by improving its technology through scalability and delivering its services in a space where enterprise clients are increasingly operating



### Why Enterprises Are Moving to the Cloud: It's Good Business

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The shift toward the cloud is a sound business practice for modern enterprises, delivering cost, efficiency, and competitiveness benefits in myriad ways.



#### *Cost Savings*

Moving to cloud-based operations pays off many times over for enterprises by allowing them to embrace digitalization without incurring the significant costs that would accompany such an undertaking if it were datacenter based. By relying on cloud-based infrastructure, enterprises don't need to invest in the capital expenditure of a new or upgraded data center, or its attendant new hardware and real estate. They can save on operating expenses, since they don't need to fund the utilities and workforce needed to maintain the data center. And they can reduce the cost of their IT departments by shifting from fixed-cost models to pay-as-you-use models.

When it comes time to launch a new application, an enterprise can realize even more cost savings through the cloud. Using a pre-cloud model, enterprises would run their applications using either their own data centers or a costly third party-run data center in both opex and capex. Enterprises can now develop and deploy an application with no capex investment, since all the application's data is stored in cloud-based infrastructure. And since the cloud features a pay-as-you-use cost structure, all the increased expenses of launching a new application can be immediately covered with the savings and profits realized by the use of the application itself resulting in a faster return on investment. And since enterprises are outsourcing their infrastructure needs, they are free to focus their time and money on data analysis and interpretation of the application's results.

Compared to a cloud-based application launch, this old model seems very costly. Enterprises can

now develop and deploy an application with no capex investment, since all the application's data is stored in cloud-based infrastructure. And since the cloud features a pay-as-you-use cost structure, all the increased expenses of launching a new application can be immediately covered with the savings and profits realized by the use of the application itself. So, in addition to obviating the need for upfront costs, cloud-based application launches also help enterprises generate a much faster return on investment. And since enterprises are outsourcing their infrastructure needs, they are free to focus their time and money on data analysis and interpretation of the application's results



#### *Security*

Data security is and always has been essential to the success of any enterprise. In a pre-cloud environment, data centers were vulnerable to numerous and ever-expanding security threats. But today, enterprises can rely on cloud service providers to offer data protection that is well beyond anything that even the largest and most advanced physical data centers are capable of. These cloud service providers guarantee that all data is encrypted and that the latest security application technologies are used to protect the cloud environments they oversee.



#### *Flexibility and Scalability*

Because adding users to cloud-based infrastructure requires only additional licensing costs, as opposed to additional hardware and additional storage, many enterprises run back-office transactions in the cloud. This saves on cap-ex costs, of course, and it also saves time and work: Upgrading takes just one click and the only remaining work might be merging databases.

This advantage in the flexibility and scalability of cloud-based operations also becomes useful on large, short-term projects. For example, if an

engineering company wins a project contract, that company will likely need to increase its workforce for the duration of the engagement. In a pre-cloud environment, this would require adding workstations and boosting storage—both of which would become unneeded after the contract is done. But in a cloud environment, this company can increase its workforce and pay for the use of IT resources for only the duration of the project, keeping the company lean, profitable, and competitive.



#### *Mobility*

More and more, large corporations are dependent upon a remote workforce. This means that enterprise applications must be reachable from beyond the traditional office setting. The best and easiest way to support this mobility: providing constant access to the cloud.

Cloud access also affords corporations the ability to expand the types of terminals that employees can use to access data and complete work. Outside of a cloud environment, enterprises often provide expensive laptops on which employees can store sensitive data, leading to a security risk when the devices become lost or stolen. But with cloud-enabled operations, workers can access data and applications from a smartphone or tablet, providing the same functionality for a fraction of the cost.



#### *Disaster Recovery and Redundancy*

Disasters are unavoidable. But business downtime doesn't have to be. Whether an enterprise's plant becomes damaged or its offices must be closed, a cloud-enabled operation has an easier time restarting business than an operation that relies on physical IT infrastructure.



## Why Satellite Infrastructure Needs to Move to the Cloud: To Stay Relevant and Useful

With enterprise customers rapidly moving their IT infrastructure to the cloud, and with this trend showing no signs of slowing, the satellite industry must follow suit. By offering cloud-first satellite services, the industry can more fully meet the needs of its customers while at the same time positioning itself for future success and growth as satellite capacity and numbers expand.

But why are cloud-first satellite services important to these enterprise customers who are themselves migrating their operations and infrastructure to the cloud?

One big reason is that enterprises embracing digitalization need ubiquitous cloud access—a service that in many places can only be achieved with satellite networks. By moving their application and data to the cloud, enterprises have added a layer of complexity to the design and management of their Wide Area Networks—a relatively small price to pay in exchange for the cost savings, flexibility, and ease of use that come along with cloud migration, but a big enough challenge that it needs a robust and effective solution. In many countries, public internet is reliable enough to access any public cloud application, providing that effective solution on its own. But in regions where public broadband is nonexistent or of poor quality, users need to rely on satellite communication to access the cloud.

Satellite has been used for years in conjunction with traditional, centralized data centers, which are often owned or run by the customer. In this topology, an IT team could easily design and tune their VSAT network for optimal efficiency. But in a cloud-based-operations world, an IT manager doesn't have visibility into where the enterprise's data or application is located, which makes network design and optimization challenging. To help with this process, the VSAT service provider must step in and become more active in managing the end-to-end network, as opposed to stopping their involvement at the teleport data port, as it had done in the past. To optimize the network, the VSAT service provider needs to either co-locate part of its infrastructure with a cloud provider or implement dedicated access to multiple public cloud providers via direct connect, express route, or a similar offering.

Running part of a teleport application in the cloud helps VSAT providers mitigate the cost of the co-location or the dedicated route that they offer to customers. VSAT service providers can deliver this cost-effective cloud access to their customers by utilizing cloud-based baseband infrastructure, an area in which ST Engineering iDirect is making advances.

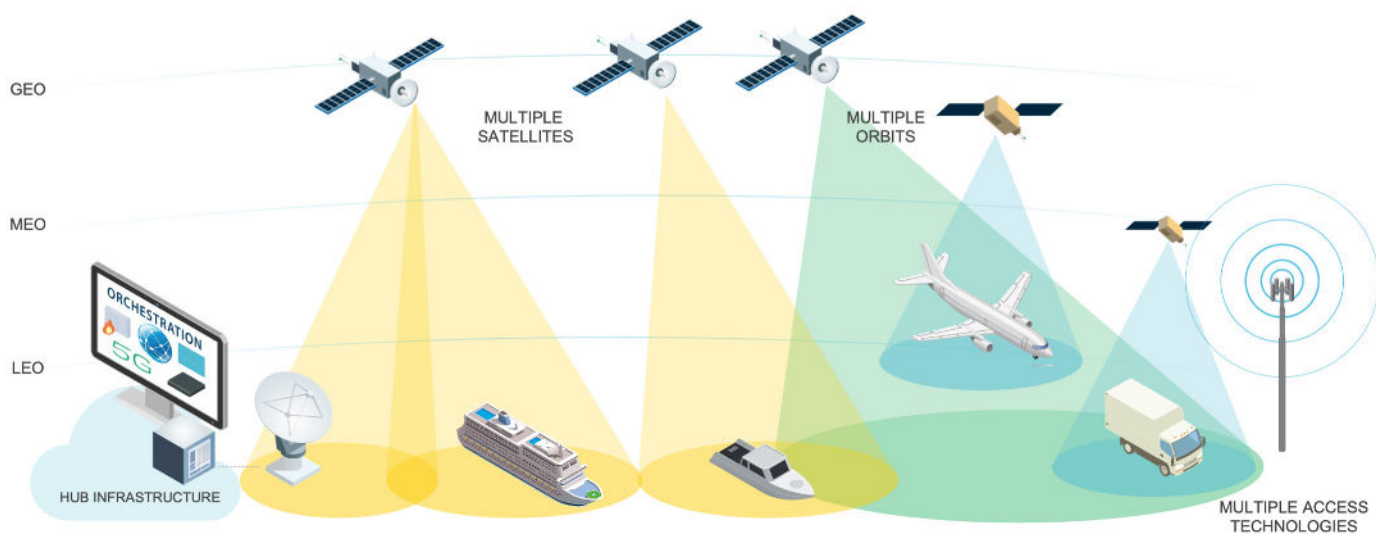
Another reason the satellite industry should offer cloud-based services is to keep pace with its enterprise customers' rapid embrace of the Internet of Things (IoT). For these enterprises, most if not all IoT applications are running in the cloud—a business-driven choice, since the cloud offers scalability and cost reduction benefits. The amount of data collected by IoT applications is an order of magnitude higher than the amount that traditional business applications would generate, and all this data needs to be aggregated and pushed to the cloud to be of analytical use to the enterprise. But issues can arise when IoT devices are located in poorly connected locations. Here, satellite is the natural option for connection, and this connection must be robust enough to transmit the IoT device's data to the teleport and then hand over the data quickly and reliably to the cloud service provider. For business applications, the teleport and gateway need to be as close as possible to the cloud infrastructure.

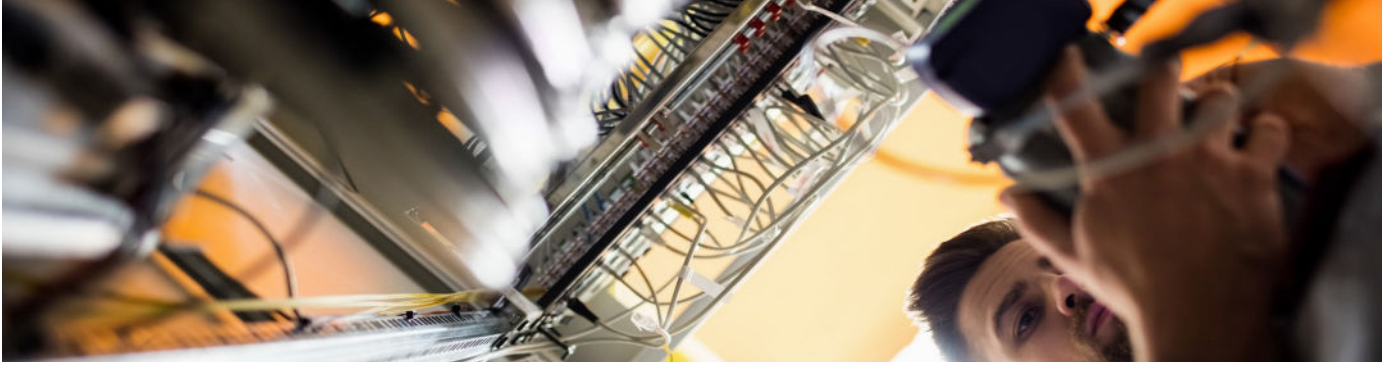
## Why Cloud and Virtualization Is Key to Unlocking Satellite's Full Potential: New Technologies, More Opportunities

As the satellite industry adopts cloud-based infrastructure to keep pace with enterprise clients that require it, there are concurrent technology innovation trends, independent from customers, that are pushing satellite toward the cloud as a means of reaching its full potential. The industry is moving away from the traditional GEO satellite architectures and toward highly flexible digitized high throughput satellites and new MEO/LEO/HEO constellations, so old ground segment technologies will no longer work. This newer generation of satellites will require a more scalable, flexible, and secure infrastructure solution, and cloud infrastructure meets those needs.

For example, cloud provides a remedy for the mounting problem of adding new equipment and processing power to ground segment gateways in an effort to keep up with the rapidly expanding beam numbers being deployed by each new generation of satellites. Traditional GEO satellites had a few gigabits per second capacity serving a low number of beams requiring low investment in ground segment technology.

But when HTS satellites hit the market, things got more complicated: The number of beams was far higher (often more than 50), and the focus shifted from coverage to capacity and power. This required a commensurate buildup of ground segment hubs to ensure they were capable of handling that many beams. Unsurprisingly, this buildup was expensive, with satellite operators or satellite service providers on the hook for creating ever-expanding hub systems that covered a lot of real estate and used a lot of power. And now the market has welcomed VHTS satellites, which use 200+ beams, and LEO constellations that comprise hundreds or thousands of satellites and have terabit per second throughput capacity. Attempting to scale ground segments to meet those needs can become so expensive and real-estate consuming as to become unwieldy: Think a multitude of equipment racks to control one large satellite network, and double that if GEO redundancy is needed.





That's why a move away from ground segment-based hub hardware and toward a cloud environment makes sense: Cloud-based solutions can accommodate current and future innovation trends in the satellite space segment by providing easy scalability without the need for additional cap-ex investments. Of course, currently available cloud-based hubs vary in their technological capabilities and features. ST Engineering iDirect offers a Dialog XIF hub that runs in a private cloud environment, which affords more scalability than traditional server-based architectures. It also launched its Intelligent Hub (iHub) for Velocity networks to further maximize the density of the baseband hardware. This hub architecture facilitates deployment flexibility and best-in-class density and performance allowing operators to deploy processing in a private data center where a single processing cluster can support multiple gateways.

Satellites in the new generation of manufacturing are being designed with digital onboard processing capabilities. This architecture allows for extreme flexibility, since these satellites are able to create large numbers of beams to provide optimal coverage to match the service needs of specific regions. These features are a boon to satellite operators who are responding to a market that is continually requesting more bandwidth. And the valuable flexibility of these satellites poses a challenge to the ground segment, as well, by necessitating equipment that can follow the satellites' scale and adaptability to the carrier, capacity, frequency range, power and contour configurations that the satellite operator programs into each satellite. These tasks need to be addressed by the ground segment's elasticity that allows the scaling in MHz and not only in number of beams.

Similarly, the interface between the ground equipment network management system (NMS) and the satellite resource controller poses a challenge for the ground segment. But by moving ground segment software to the cloud, these challenges can be minimized, since the cloud provides the agility and flexibility, as well as the standardized application programming interface (API) environment, to support the combined space and ground resource orchestration.

### **Why Virtualization Is Important Right Now: Discrete Improvements, Holistic Benefits**

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For satellite ground infrastructure operators switching to the cloud isn't a simple one. There are myriad details, transitions, and processes that need to be attended to—each vital to the overall success of the transition to virtualization. Satellite industry leaders need to be thinking ahead and minding the minutiae to secure enterprise customers' trust and ensure future viability. As this momentous shift continues apace in the satellite marketplace ST Engineering iDirect has been leading—and continues to lead—the way on a number of important technologies and practices.

### Private vs Public Cloud-Based Infrastructure

One of the chief goals of satellite infrastructure virtualization is to enable network providers to build out massive networks in less time, allowing for faster and more cost-effective scaling of operations. ST Engineering iDirect is innovating on this front. We will offer on-premise vs cloud, private vs public cloud models dependent on the deployment preferences of service providers. Each deployment scenario has unique advantages. In the case where service providers are running numerous on-premise applications a deployment close to the teleport makes sense to avoid high bandwidth consumption on the fiber backbone. When running always-on services a deployment on private cloud infrastructure might be more cost-advantageous by avoiding certain public cloud fees. Whereas in the case of more flexible and dynamic consumption patterns access to the public cloud is more cost-effective so that the infrastructure can fluctuate with the changing demand. Having access to all these different service models allows service providers to easily scale up their services and capabilities based upon end user use cases, and to easily bring new ones to the market.

### Baseband and Modem Functions

As service providers move toward operations on VHTS and multi-orbit constellations, with networks that operate with multiple beams per region or satellite, baseband equipment will need to be upgraded to accommodate this new reality.

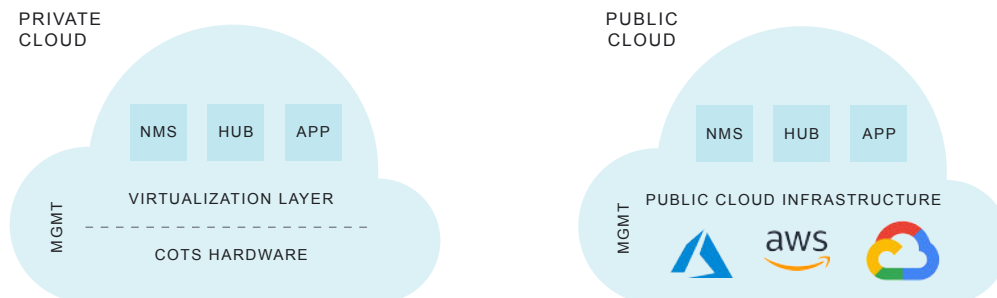
Modems also play a big role in satellite network connectivity, and that will remain true even after the switch to cloud-based operations. To interoperate easily and to run in the cloud, satellite modems will have to

become more software-defined. An abstraction of the software functionality from the hardware is the direction ST Engineering iDirect is pursuing. Recently it 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.

And in the interest of providing the biggest advantage at the lowest cost for satellite manufacturers, operators, and users, ST Engineering iDirect recently started an open collaboration with ecosystem partners on the development of an interoperability standard for the SATCOM industry, namely a digital interface standard. It will enable all manufacturers to build interoperable technologies that work in both open and closed network topologies digitizing the interface between modem and RF components.

### Network Management System

Whereas a network management system (NMS) used to be stationary and more rigid in its deployment options, a cloud-native design however allows for an NMS to be deployed in different models. For example, the NMS can be deployed on dedicated hardware, in a private enterprise cloud, or on a public cloud. This flexibility offers options, from typical capex to more flexible opex. ST Engineering iDirect is currently developing a cloud-based NMS that allows for maximum flexibility for VSAT service providers.



## Why Service Orchestration Is Crucial: It's the Key to Improving Customers' Quality of Experience

As demonstrated above, cloud applications can and will provide numerous benefits to both the satellite industry and its enterprise clients. But it's also true that the cloud adds some operational challenges, too: It adds complexity to network design; it introduces more fragility to the access route; and it can make quality of service definition more difficult.

This is where service orchestration comes in. These network management tools are often deployed by ground segment manufacturers to provide targeted service as seamlessly as possible. But because today's existing tools won't work to manage a VSAT solution that accesses the cloud, it is incumbent upon the satellite industry to provide users with service orchestration tools that enable a robust end-to-end quality of experience.

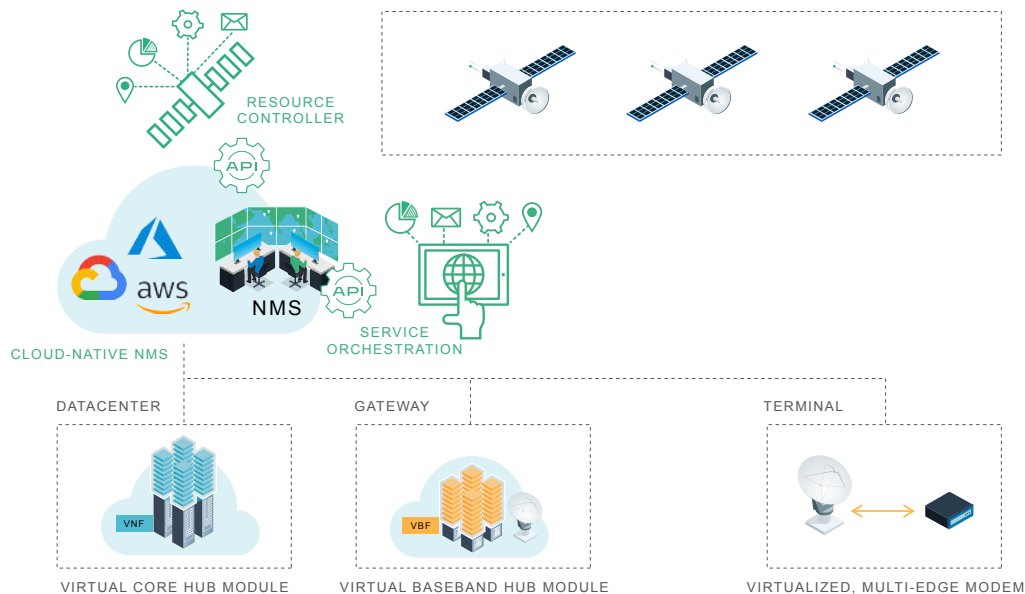
ST Engineering iDirect is building APIs to enable cloud-based service orchestration tools that act as another layer atop the traditional NMS that VSAT service providers use. In such a scenario ST Engineering iDirect's platform elements will be orchestrated through the use of application programming interfaces (APIs), including the dynamic orchestration of satellite capacities and network and hardware configurations, such as hub elements and

terminal configuration, as well as quality of service profiles. These APIs will enable true service orchestration that can quickly evaluate and match satellite payload and demand scenarios, with all hardware and software systems reacting dynamically to changing conditions. The objective: enabling service providers and satellite operators to offer a flexible, efficient, and highly scalable service offering.

## Why Cloud Technology is a Step Forward in Security: Next-Level Redundancy, Next-Gen Protection

Between a worldwide pandemic upending the way we all work and the ever-increasing concern about data security is top of mind for all enterprises. Fortunately, the trend toward cloud-based operations provides timely and powerful solutions for these pressing challenges.

In today's teleport world, disaster recovery plans consist of simply duplicating all hardware in two different locations. But this solution is costly and is very rarely fully implemented, and this arrangement sets up a scenario in which a compromised teleport necessitates a service provider swapping service manually. Obviously, the current backup system is less than ideal, leaving enterprises vulnerable to permanent loss of important data. But in a cloud-based environment, these challenges are nullified. Computing hardware is no longer located at the





teleport and does not need to be duplicated in the cloud. So, for providers it will become easier to switch from one gateway to another, since this operation is performed automatically and seamlessly in case a disaster strikes.

Security has been a focus for enterprises, the satellite industry, and beyond for decades, of course. But with the advent of increasing digitalization of the infrastructure and applications, digital security is becoming more and more important in building an Enterprise Network—and network security concerns are driving a need for improved security in ground infrastructure.

Traditional teleports are usually designed with physical security in mind, rather than digital security, and with IT hardware rapidly multiplying, the risk of hacking a network management system multiplies, as well. Combine these risks with the inherent difficulty of maintaining a firewall while operating multiple teleports in different parts of the world and you can see why shoring up security vulnerabilities is a leading priority. One possible solution would be to increase IT staffing at significant cost and use multiple manual security processes that are prone to error.

A cloud-based environment offers a more efficient and attractive option. The cloud brings a level of digital security that individual teleports or service providers will not be able to afford. And it provides access to cloud-based management tools for firewall and other security applications, which makes it easier to propagate user clearance or access rules to all sites in use.

## Why the Satellite Industry Needs to Embrace the Cloud Now: Opportunity, Opportunity, Opportunity

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Cloud capabilities open broad avenues of opportunity for satellite service providers, satellite operators, enterprise customers, and everyone in between—opportunities to improve service offerings, increase security, and, ultimately, grow revenue streams.

Service providers can offer their clients much-needed access to cloud-based applications. Providers and satellite operators can gain privileged access to a complete family of networking applications, such as NGFW Next Generation Firewall Wall (NGFW), SD-WAN, and Deep Packet Inspection (DPI). And they can then package these applications into advanced service offerings that will provide customers with not only satellite connectivity, but also cybersecurity, hybrid network, application-based QoS, and end-to-end service orchestration. This cloud-hosted hub infrastructure also gives providers and operators the capability of building an edge cloud offering that's tailored specifically for satellite connectivity.

With these kinds of broad-based performance improvements and wide-ranging opportunities at our disposal, the time has come for the satellite industry and enterprise service providers to fully embrace the cloud.

