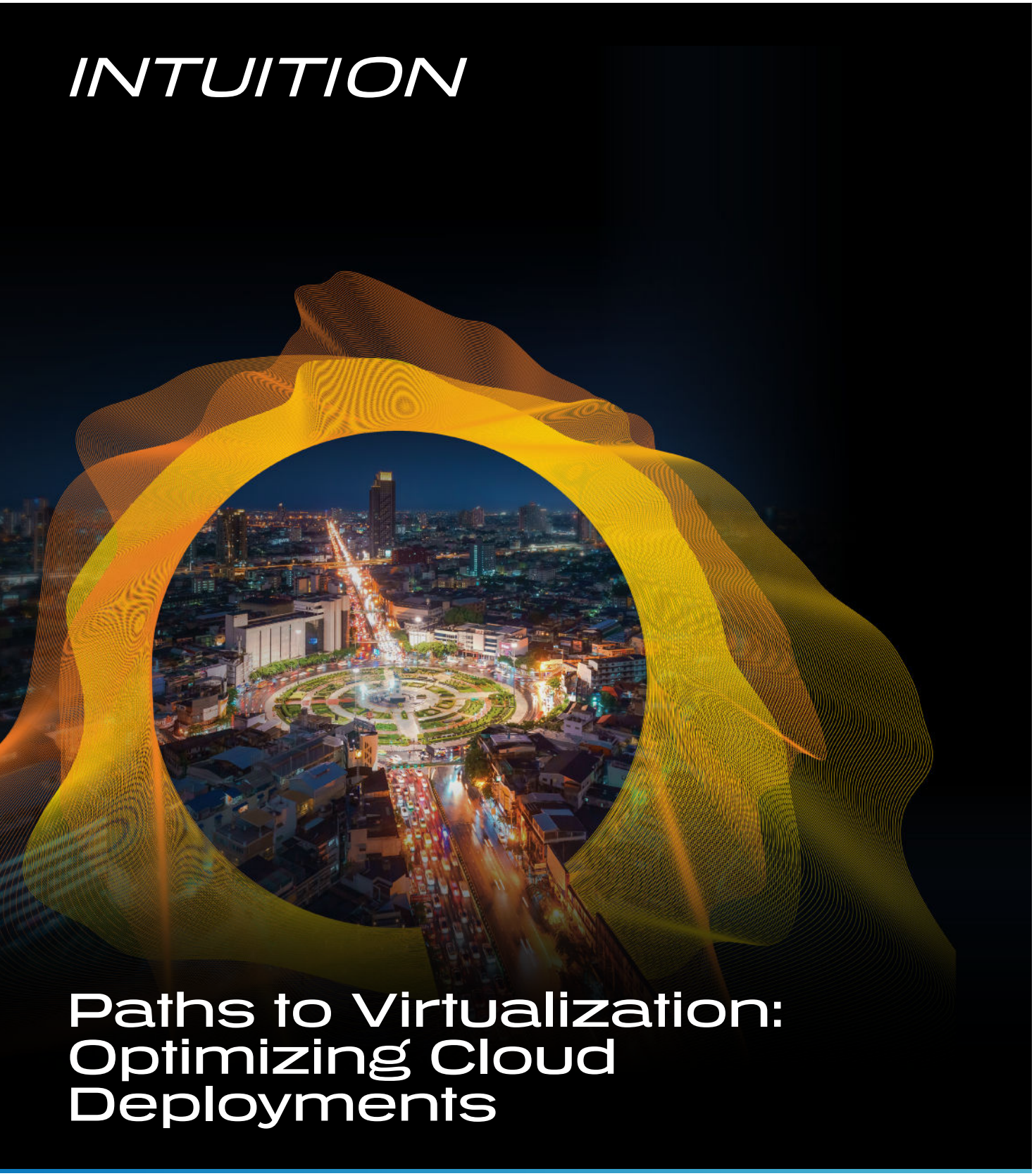
INTUITION



Paths to Virtualization: Optimizing Cloud Deployments

iDirect

Transitioning to the cloud for the Satcom industry represents an unprecedented opportunity for transformation. The cloud, encompassing both public and private cloud solutions, offers satellite operators and service providers new methods of service delivery and faster time to market, the ability to transform and digitalize their infrastructure, and cost reductions. Flexibility is another key advantage of cloud adoption, enabling satellite operators and service providers to swiftly adapt to changing market demands and technological advancements. This adaptability allows for seamless scaling of operations—whether expanding to meet increased demand or downsizing during quieter periods. Furthermore, the cloud's flexible infrastructure facilitates the integration of new services and applications, empowering them to continuously innovate and remain competitive in a rapidly evolving industry.

With such promising benefits, satellite operators and service providers are keenly adopting virtualization and cloud technologies to redefine how networks are managed and scaled.

KEY TRENDS DRIVING VIRTUALIZATION AND CLOUDIFICATION

According to Analysis Mason, Satcom cloud traffic and revenue are projected to grow at a compound annual growth rate (CAGR) of 20%, reaching $46 billion by 2033. Satellite operators and service providers see the adoption of cloud and virtualization as an important strategy to remain competitive. They aim to replicate the successful strategy that telcos have embraced for years—one centered around adopting cloud and virtualization through advances in 5G technologies, software-defined networking (SDN) and network function virtualization (NFV).

Integrating cloud services into their core infrastructures and moving into software-defined architectures promises satellite operators and service providers key advantages.

- Dynamically adjusting resources based on network demand and thus only having to pay for the resources required allows them to become more cost-efficient and move from capex to opex.
- Leveraging more COTS equipment in private cloud avoids platform vendor lock-in.
- Virtualized deployments would speed up their time to market and thus time to revenue.
- Gaining access to cloud-based tools for analytics and automation technologies, driven by AI and machine learning, can enhance operational efficiency automating customer onboarding and monitoring network performance.
- Virtualization and Digitalization enables the convergence to 5G Integrated frameworks enabling seamless interoperability between terrestrial and satellite networks.

By combining virtualization, automation, and cloud integration, satellite operators and service providers are poised to drive cost-efficiency, accelerate time to market, offer innovative services and enhance operational efficiency.

KEY CHALLENGES IMPACTING WIDESPREAD ADOPTION

Sovereignty rights are a concern for service providers. Deploying satcom connectivity on public cloud providers can raise issues around compliance with local regulations of data sovereignty, ensuring adherence to stringent governmental and enterprise-specific security standards.

Cost barriers also present a significant hurdle. Cloud Service Providers (CSPs) charge for virtual machines or containers, CPUs, and memory usage, as well as for both incoming (ingress) and outgoing (egress) data traffic between the cloud availability zones, regions and on -premises locations, such as private datacenters or teleports. For high-volume data traffic, these costs can be substantial, particularly for baseband processing in a satcom network. Unlike network processing, which requires only small amounts of data for networking, routing, and QoS, baseband processing functions are more data-intensive as they handle modulation, error correction, and data compression.

While public cloud offers significant advantages, especially for occasional use cases, the high data rate traffic used in satcom necessitates careful consideration by satellite operators and service providers regarding which satcom operations to deploy in the cloud and where.

HYBRID MODELS FOR OPTIMIZING CLOUD DEPLOYMENTS

What if satellite operators and service providers could choose which of the ground segment operation functions to deploy in the cloud, rather than being limited to fully purpose-built hardware or complete cloud deployments?

Intuition offers customers the flexibility to choose between private cloud and public cloud deployment options for Network Management Systems (NMS) and Network Processing. This approach ensures that satellite operators and service providers can select the most cost-effective and efficient deployment strategy tailored to their specific needs.

GROUND SEGMENT VIRTUALIZATION EXPLAINED

By definition virtualization separates software functions from hardware, running them as virtualized Network Functions (NFs). This transition uses Virtual Machines which employs hypervisors for software abstraction and Containers, now an industry standard, for running individual applications. Containers are ideal for microservices and cloud-native applications due to their resource efficiency. To manage these deployments platforms like Kubernetes, the industry standard for container orchestration, and its commercial counterpart, Red Hat OpenShift, can be effectively leveraged. Instead of relying on specialized, purpose-built hardware, operators can use Commercial Off-The-Shelf (COTS) servers to host these functions:

NETWORK MANAGEMENT SYSTEM (NMS) PROCESSING hosted in a cloud environment utilizing cloud-native standard technologies.

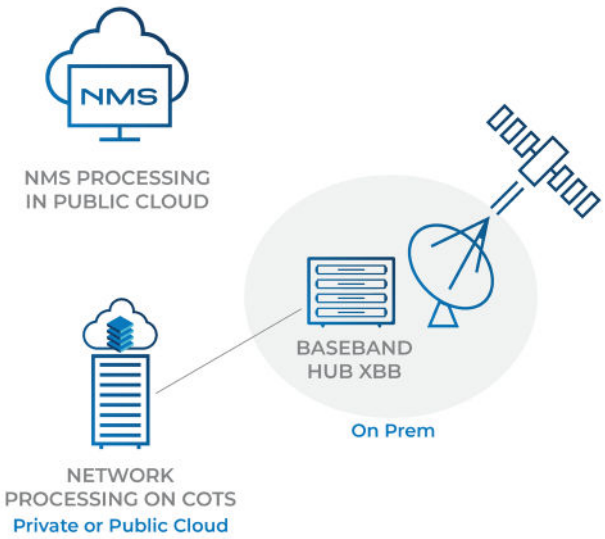
NETWORK PROCESSING FUNCTIONS responsible for executing processing tasks within the datapath.

HUB BASEBAND PROCESSING FUNCTIONS including all signal and waveform functions

REMOTE MODEM FUNCTIONS can be deployed on 3rd party CPE or COTS edge devices

Given the compute and traffic-intensive nature of Baseband processing, it typically remains on-premises, utilizing high-density Physical Network Functions (PNFs). This setup allows for optimal performance and resource utilization, ensuring that critical baseband functions are handled with the necessary computational power and bandwidth.

TCO OPTIMIZED CLOUD DEPLOYMENT

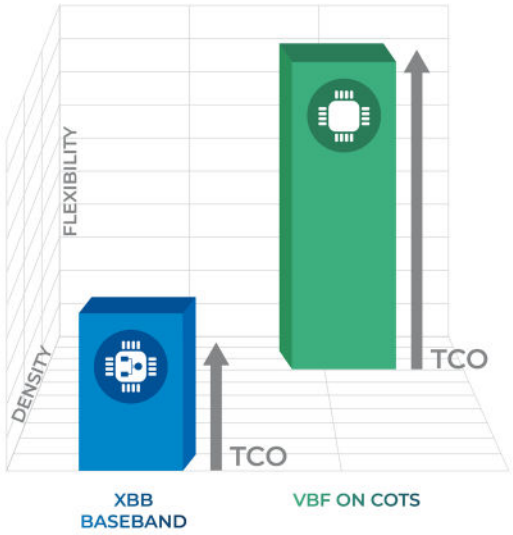


By leveraging hybrid deployment models, Intuition enable seamless integration across on-premises and cloud environments, balancing physical and cloud network functions to achieve the best total cost of ownership (TCO). Satellite operators and service providers can transition to cloud deployments at their own pace, aligning with their network requirements and cloud pricing models.

This flexible approach not only optimizes costs but also enhances operational efficiency, providing a robust and scalable solution for satellite operators and service providers. Whether deploying in a private or public cloud, Intuition ensures that all network functions are managed effectively, delivering high performance and reliability.

When it comes to Hub Baseband Processing satellite operators and service providers have the choice: While virtual baseband processing functions (VBF) in the cloud allow for more flexibility, keeping baseband processing in a high-density appliance on-prem lowers the overall TCO. Since iDirect Intuition offers both options, high density appliance and VBF on COTS, one can always transition to the other deployment option if circumstances or tradeoff priorities change.

One such hub baseband solution is iDirect's XBB, a compact, high-density hub appliance equipped with high-performance baseband modules handling the Network Functions.



USE CASES THAT BENEFIT FROM HYBRID DEPLOYMENT SCENARIOS ARE:

SMART GATEWAY DIVERSITY

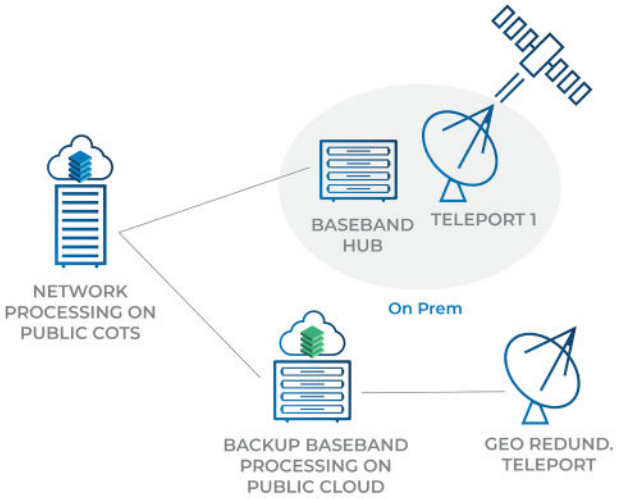
Operators can achieve geographic redundancy and enhance network diversity more cost-effectively by leveraging dynamic and automated deployment of redundant network and baseband processing. This can be done using either public cloud or shared capacity. In the event of a disruption at the primary location, network traffic can be seamlessly switched to the cloud setup. This approach leads to significant CapEx savings, as it eliminates the need to build and maintain a fully redundant geo-diverse system on standby. By deploying baseband processing only when needed, and automating resource allocation, operators can optimize resource utilization and reduce operational costs, ensuring a resilient and efficient network infrastructure.

DISASTER RECOVERY

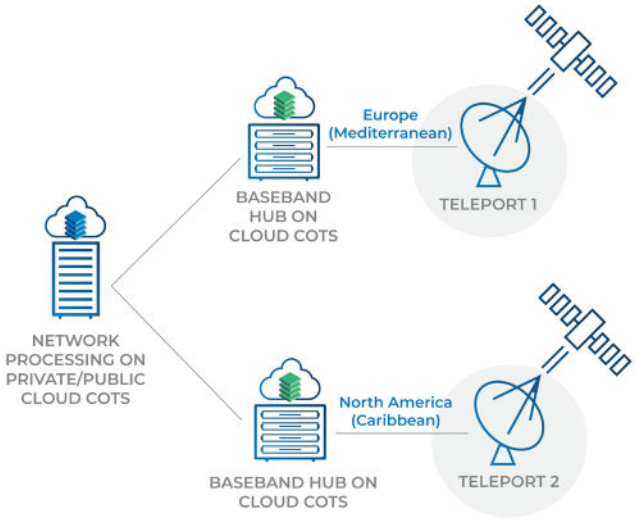
Hybrid cloud solutions can provide a robust disaster recovery strategy. By replicating critical data and applications to the cloud, businesses can ensure continuity in case of on-premises failures. This approach allows for quick recovery times and minimizes downtime, ensuring business operations can continue smoothly.

SEASONAL TRAFFIC EXPANSIONS

Service providers can right-size their network for seasonal or event-driven traffic surges by dynamically scaling operations in the cloud. For example, when serving the cruise market with seasonal traffic in the Caribbean and later in the year in the Mediterranean, service providers can avoid the cost of maintaining one fully loaded and one barely loaded network architecture. Instead, they can centralize all network functions in the cloud, paying only for what they need. This automated and flexible approach allows for quick scaling of services during peak periods or special events, ensuring that resources are efficiently allocated to meet customer demands without the need for upfront investment in additional infrastructure.



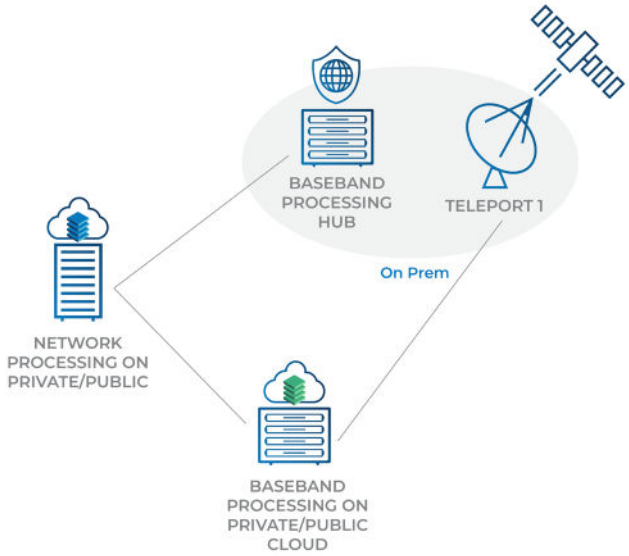
USE CASE #1: GATEWAY DIVERSITY/ DISASTER RECOVERY



USE CASE #2: SEASONAL/ EVENT TRAFFIC

MARKET AND SOVEREIGNTY STRATEGIES

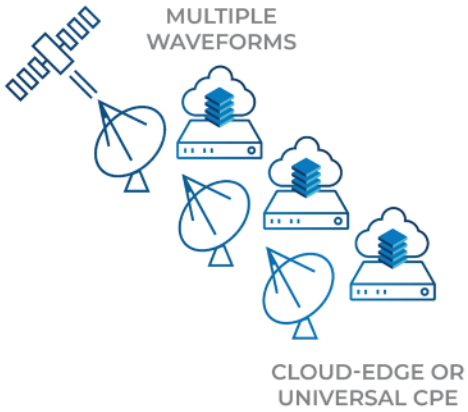
When serving multiple markets hybrid cloud deployment options allow service providers and satellite operators to balance the scalability and flexibility of cloud for the majority of the markets with those specific requirements for on-premise requirements for mission-critical or high-value traffic due to sovereignty concerns. They can move large-scale, low data processing for high-volume markets like enterprise maritime or fishing to the cloud, while mission-critical traffic stays on-prem near the teleport serving all market needs with a single ground segment system.



USE CASE #3: TRAFFIC SOVEREIGNTY

VIRTUALIZED MODEM DEPLOYMENTS

With the abstraction of modulation and demodulation from the hardware and the containerization of these functions, virtualized remote modem functions can also be deployed on COTS or 3rd party equipment at the remote side. This enables service providers to have more flexible choices when it comes to in-region deployments. They can operate virtualized modem capability on cloud edge of a regional cloud provider's COTS equipment or they can run the modem software on universal CPE that already hosts other waveforms. Adding that additional deployment scenario to their modem portfolio where it makes sense increases the service provider's flexibility, speed to market and speed to revenue.



USE CASE #4: VIRTUALIZED MODEMS

Scenarios like occasional use, disaster recovery, network diversity, and non-sovereignty-sensitive deployments are prime examples where hybrid cloud deployments solutions are highly effective. By utilizing these hybrid options, satellite operators and service providers can strategically deploy across on-premises and private or public cloud environments based on their specific needs. Ultimately, having multiple deployment solutions to choose from allows satellite operators and service providers the freedom to balance the need for flexibility and scalability with Total Cost of Ownership.

OTHER BENEFITS OF CLOUD DEPLOYMENTS

CLOUD ENVIRONMENTS FOR SYSTEM DEVELOPMENT AND TESTING

Hybrid cloud environments are ideal for development and testing purposes of Ground Segment System builds and releases as Developers and Testing Engineers can use the cloud to quickly spin up and tear down environments as needed. This would also allow Early Field Testing to be done in cloud environments without the need for building out or maintaining extensive lab networks. The flexibility that comes from using hybrid cloud environments would significantly reduce upfront investment in lab hardware and accelerate the development, testing and deployment cycles.

CLOUD PROPELS CHANGING BUSINESS MODELS

The transformation of the Satcom industry through virtualization and cloud adoption is not limited to improving flexibility and scalability, it is also propelling innovative business models and operational strategies. With scalable cloud infrastructure and enhancements in cloud security satellite operators and service providers are becoming increasingly interested in As-a-service offerings. Delegating the operation to ground segment providers who may choose to deploy the platform capabilities in the cloud or on-prem allows for faster access to advanced capabilities, accelerating time to market and enabling service providers to focus on their core business functions.

A CONNECTED AND SOFTWARE-DEFINED FUTURE

Transitioning to the cloud represents an unprecedented opportunity for the Satcom industry, offering satellite operators and service providers new methods of service delivery, faster time to market, and the ability to digitalize and integrate their satellite ground segment seamlessly with other terrestrial infrastructure and 5G. Virtualization and cloud technologies are enabling Satcom operators to redefine how networks are managed, scaled, and optimized.

To capitalize on these advancements, operators must carefully evaluate their ground system deployment strategies, ensuring alignment with their goals for TCO, performance, and scalability. This may involve beginning with a hybrid deployment model and transitioning to the cloud if and when cloud cost models evolve.

Intuition offers flexible pathways to virtualization, optimizing cloud deployments for TCO while guiding satellite operators and service providers through every stage of their transformation.

INTUITION
AT EVERY STEP