DIGITAL IF USE CASES

Virtualisation

DIGITAL TRANSFORMATION

Traditional satellite ground stations are hardware-centric. This architecture has constraints on flexibility and cost efficiency, which impacts scalability. Digital IF's conversion of RF signals into IP packets is a critical enabler of virtualised ground functions, opening the door to a new era of ground segment deployments.

OPERATIONAL BENEFITS

By transferring signals into the IP domain, Digital IF:

- moves functions such as modulation, spectral analysis, and modem operations to virtual environments.
- operators can deploy new waveforms and services as virtual network functions (VNFs).
- enables agile scaling; operators can spin up capacity to handle peak traffic periods, then release the resources when demand subsides without touching physical hardware.
- accelerates innovation cycles. Software updates, security enhancements and the deployment of new features occur centrally, reducing downtime and complexity and increasing visibility.
- transforms capital expenditure (CAPEX) into operational expenditure (OPEX).

INTEROPERABILITY

DIF has seen collaboration at an unprecedented level across the industry. Modem suppliers, RF manufacturers, government bodies, antenna manufacturers, and more have come together as part of the DIFI Consortium to drive a new industry standard for Digital IF.

The DIFI standard ensures VNFs and physical elements from different vendors can work together, reducing vendor lock-in and fostering the growth of a competitive ecosystem. Virtualisation will unlock cost and performance optimisation for modern teleport operators and GSaaS providers who are seeking competitive advantage in an increasingly diverse satcoms landscape.

DIGITAL IF USE CASES

Tactical Communications

THE BRIDGE BETWEEN PAST & FUTURE

Digital IF – also known as RF over IP – is designed to bridge the analogue legacy of RF signal transport with modern, networked ground segment architectures. It transforms how defence and government stakeholders deploy and manage satellite links.

OPERATIONAL BENEFITS

In forward-deployed or contested environments, traditional analogue RF links are constrained by the need for physical connectivity and susceptibility to environmental interference. Digital IF delivers a decisive advantage. It digitises RF signals close to the antenna, encapsulating them as IP packets, and transporting them over robust ethernet and IP networks to central processing or cloud-hosted ground segment functions. This approach decouples the antenna from the modem, allowing operators to dynamically re-route signals and maintain connectivity even when infrastructure is degraded or threatened.

This decoupling serves tactical operations in several ways:

- It enhances operational flexibility, meaning teams can reposition antennas without needing to integrate modems or other hardware in potentially vulnerable locations, reducing risk exposure.
- It enables consolidated signal processing at secure, centralised facilities, reducing the vulnerability of critical assets in theatre.
- It maintains high fidelity over long distances and through challenging environments without degradation, a critical requirement when satellite terminals must support real-time command and control, intelligence, and high-bandwidth communications under pressure.

PAVING THE WAY

Incorporating RF over IP into tactical networks lays the technological foundation for future innovations, such as cloud-based virtualised waveform adoption, adaptive beamforming, and rapid remote reconfiguration of network flows. Combined with the precise timing capabilities inherent in digital conversion, this creates a synchronisation that makes DIF particularly useful for time-sensitive, multi-site operations across dispersed forces.

DIGITAL IF USE CASES

NGSO Systems

THE CHALLENGE ON THE GROUND

Non-Geostationary Satellite Orbit (NGSO) constellations present unique ground segment challenges. Their high satellite velocity and frequent handovers demand precision timing and rapid, reliable switching. Digital IF (DIF) is well-positioned to meet these requirements.

OPERATIONAL BENEFITS

One of DIF's standout capabilities is precise timestamping and synchronisation of signals. This makes it possible to execute handovers between antennas seamlessly, ensuring continuity for NGSO satellites as they pass above ground stations. Precise timing also supports advanced functions such as interferometry for interference localisation and high-accuracy geolocation, enhancing spectrum management and operational planning.

For satellite operators and service providers, this translates into a more agile and responsive ground segment. By centralising processing and using standardised digital interfaces, operators can:

- scale capacity dynamically in response to changing demand and load.
- reduce overall system complexity through minimising hardware requirements and moving to a software-led network architecture
- leverage the resulting cost effectiveness and reliability to derive commercial advantage, even at scale

DIGITAL IF USE CASES

Security

THE MODERN SECURITY CHALLENGE

In today's geopolitical climate, assured communications are vital to maintaining national security. The threat is no longer just physical - satellite ground segments must defend against both signal interception and cyber threats. Digital IF – also known as RF over IP – fundamentally strengthens network security by decoupling processing functions from exposed physical locations and enabling robust, sovereign encryption.

OPERATIONAL BENEFITS

With analogue RF, signal processing often occurs near the antenna, exposing expensive and mission-critical hardware to both physical and cyber threats. Digital IF allows a digitised RF stream to be transported via encrypted IP links to secure data centres or cloud infrastructure for processing. The physical antenna remains in the field, while the sensitive functions are protected 'behind the fence'.

Digitisation of the signal at the antenna:

- limits personnel and equipment exposure to physical attack or espionage.
- ensures that signals are less susceptible to interception over fibre or via network connections.
- allows well-established modern cybersecurity tools, such as intrusion detection systems, firewalls, and micro-segmentation, to be applied within the virtual environment, adding further layers of defence.
- consolidates high-risk functions in centralised, secure facilities.

FUTURE-PROOF COMMUNICATIONS

Utilising RF over IP supports a satcoms network that aligns with modern best practices for distributed communications, safeguarding mission success and sensitive data in high-threat environments. It also provides the stepping stone to the future software-defined era of satellite communications, ensuring government and defence users have the flexibility and capability to respond to a changing satcoms landscape.