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# Network Infrastructure Restoral

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## Overview

Trunking circuits – the terrestrial fiber or submarine communications cables that transmit data within your core network. It comes with the promise of enabling the delivery of voice and broadband...that is, until the link is cut. The cut (break) can be unintentional, such as the result of a natural disaster or a construction company doing excavation. Or, the cut can be intentional, such as vandalism or corporate malicious conduct. Regardless of the cause, the result is the same...a breach in connectivity, which results in service interruption.



If you currently have, or are considering multi-site infrastructure restoral over satellite, read on for insight that could help you ensure cost-effective service continuity, so you can remain operational and profitable in the event of terrestrial communications failure.

## Considerations, Complexities & Costs

Unfortunately, fiber/cable is often the weakest link in mobile networks. First, the sheer volume of traffic that is affected has an impact on a massive subscriber base. Its susceptibility to damage and interruption can negatively impact both service levels and revenue continuity for Mobile Network Operators (MNOs). Given your requirement for highly reliable core infrastructure and transport, MNOs like you are looking to satellite-based solutions for network infrastructure restoral. Satellite provides the ideal solution given its resilience, flexibility and global, ubiquitous coverage. There are, however, a number of considerations, complexities and costs that must be evaluated when selecting a satellite-based solution that is cost-effective, efficient and able to deliver guaranteed service.



When establishing an infrastructure backup, you need to consider how much satellite space segment is needed. Should you encounter a network outage, you need to have sufficient bandwidth to restore services. However, it can be cost prohibitive to provision backup satellite capacity for all sites at peak traffic levels.

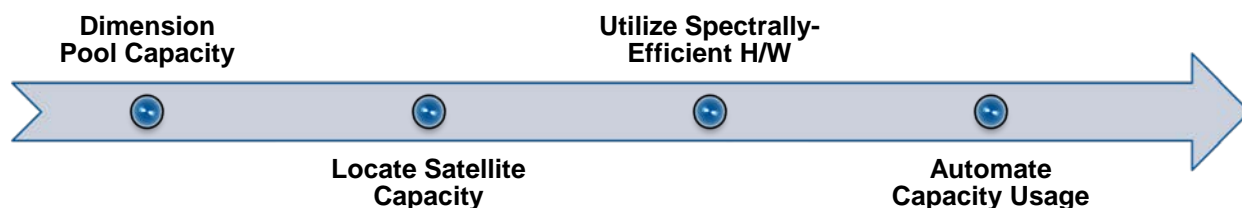
Satellites are not affected by terrestrial events, and statistically not all sites will be affected by planned or unplanned events simultaneously. Therefore, the most cost-effective solution is an automated one that allows you to transfer traffic when there is an outage from cable to satellite. You need the ability to consolidate and share services, to use the fewest amount of satellite resources, and to move resources around when and where needed.

You may have sites on multiple continents. Therefore, to properly provision satellite restoral service options, you may need to deal with multiple transponders across an array of bandwidth segments and a range of satellite service providers. You need a solution that can reduce your operating costs throughout the year, but still provide the assurance of service for your subscribers.

Another common challenge is not having co-located staff proficient in satellite. In the event of network failure, it may not be feasible or cost-effective to manually reconfigure and re-arrange satellite transponders and links for remote locations. You need a solution that doesn't require on-site specialized resources.

There is an array of satellite-based communication options. While this will be your backup infrastructure, you still need a solution that provides the highest performance possible and enables timely packet delivery and service differentiation. As costs are a key consideration, you need a solution that leverages the latest bandwidth-saving technologies.

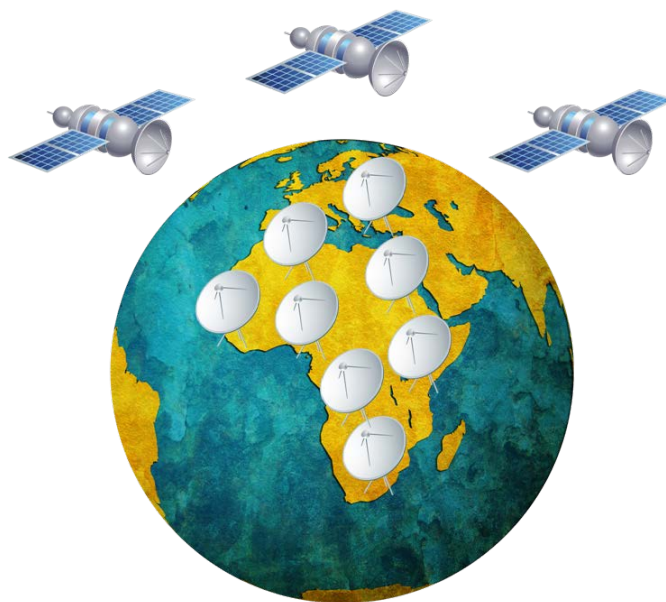
## Automated, Flexible & Cost-Effective Restoral – A System Level Approach



### ***Dimension Pool Capacity***

Whether you lease the satellite bandwidth already, or are getting ready to, you need to determine how much capacity you need to support your restoral services. There are many parameters that need to be considered, including satellite footprints, data rates, power requirements, etc.

Comtech EF Data offers a mathematical method of determining your required capacity. We will work with you to determine how much capacity you need. Once we understand what is needed for 100% restoration, we will look at the probability of failure for each site. From there, we can run numerous failure scenario iterations targeting a total network availability that suits your needs. Once we understand the needed data rate network capacity, we can run link budgets and probability analysis to define the minimum bandwidth required to meet the target network availability. If you opt to utilize an automated backup system and spectrally-efficient tools, you will be poised to require significantly less satellite bandwidth.



Proper dimensioning of bandwidth is largely based on pooling the bandwidth resources. When resources are shared in a pool, you can use statistical probability as an “oversubscription” model. In an ideal world, everyone would access the same pool of bandwidth by statistically aggregating the services and using (sharing) the same pool of bandwidth.

When selecting the right resources, satellites with footprints covering all or most of your sites are preferred. You want as many of the sites to look at the same satellites as possible for maximum bandwidth pooling resources. Ideally, you want to look for a single footprint with sufficient capacity that all of the sites can see. Focusing on the ever-present need to reduce OPEX, the ground equipment can then be sized to match the satellite footprint.

This may be one of your most important steps in establishing backup restoral services. If you have more than one terrestrial service that you want to aggregate and you would like to leverage a platform that can save you bandwidth and OPEX, then you would be well served to allocate considerable time to the process of dimensioning pool capacity.

### **Locate Satellite Capacity**

Which satellite operators, and specific facilities, should you contact? How much bandwidth and power do you need? Identifying the best satellite resources can be a very time-consuming and challenging task.

We have long-standing relationships with satellite operators globally. Our contacts span the operators' headquarters, in-country facilities and teleports. By leveraging these contacts, we can help you identify the key contacts and locate the most suitable satellite capacity.

### **Utilize Spectrally-Efficient Hardware**

In order to best utilize your satellite capacity, you need infrastructure hardware that provides maximum spectral efficiency. A significant amount of our development resources are focused on creating patented and industry-leading technologies that provide unrivaled spectral efficiencies. We will work closely with you to determine which of our tools and technologies are most suitable for your specific network and applications. Our goal is to help you



identify the optimum products and tools for maximum spectral efficiency. Examples of technologies that are particularly useful for reducing the cost associated with satellite communications for infrastructure restoral are summarized below.

**Vipersat Management System (VMS)** – The VMS provides scalable, dynamic SCPC (dSCPC) capacity management that facilitates bandwidth sharing, automates space segment allocation and allows for establishment of efficient, low latency, low jitter links. It manages “pools” of available bandwidth and allows carriers to be setup, torn down and resized dynamically within the pools.

VMS dynamically finds and allocates capacity depending on how many circuits are down. You won't need to contact satellite operators, manually adjust frequencies, power or symbol rates. After you have purchased the appropriate amount of satellite capacity VMS will handle the satellite circuit configuration. When there is a failure, VMS will find the appropriate space on the satellite, find the appropriate transponder, and put up the carrier. It is programmed to know if there is a failure, how much capacity is needed to transmit and receive. The power levels, symbol rates, modulation and coding are pre-programmed. So, when there is a failure, VMS looks at all of the available resources and determines where to put the circuit. The circuit is dimensioned and sized according to available transponders, essentially doing everything the operator would normally have to do. It actually manages the automation of putting a carrier up and tearing it down when you have an outage situation. The convenient GUI and network control also provides fault monitoring, event recording, and more.

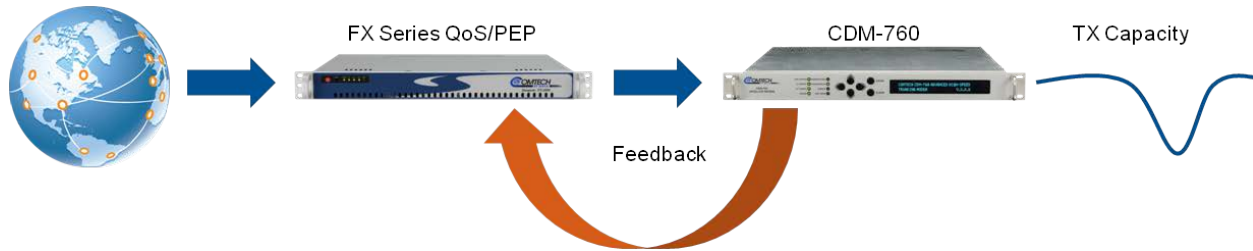


**DoubleTalk® Carrier-in-Carrier®** – based on patented “Adaptive Cancellation” technology, allows transmit and receive carriers of a duplex link to share the same transponder space. DoubleTalk Carrier-in-Carrier is complementary to all advances in modem technology, including advanced FEC and modulation techniques. It can enable you to achieve spectral efficiencies that cannot be achieved with traditional links. In simple terms, DoubleTalk Carrier-in-Carrier can be used to save transponder bandwidth and/or transponder power.

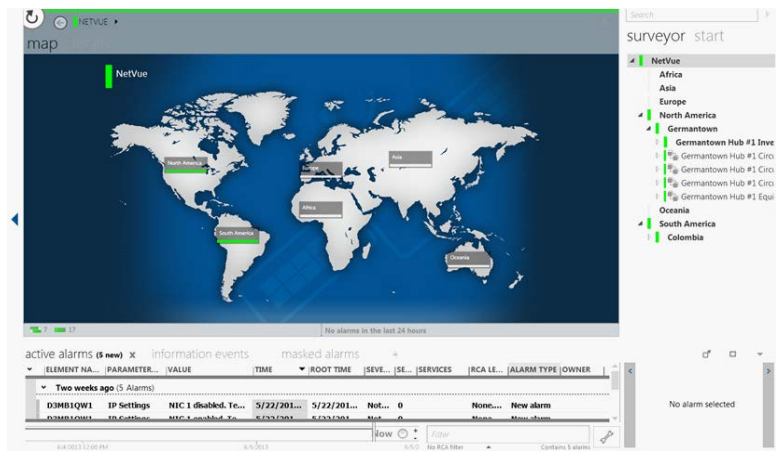
**DVB-S2-EB1 (Efficiency Boost)** – DVB-S2 is widely accepted as the most spectrally efficient standards-based waveforms. With our Efficiency Boost technology, you can achieve a 10% – 35% increase in efficiency over the DVB-S2 standard without an increase in power or occupied bandwidth. Our technology virtually doubles the number of available MODCODs compared to DVB-S2, which provides more throughput options to facilitate optimal combinations. DVB-S2-EB1 includes additional roll off figures (15%, 10% and 5%) which translates into additional, incremental capacity.

**Adaptive Coding & Modulation (ACM)** – a statistical, non-static advantage that enables dynamic changes in user throughput. ACM doesn't change the power or the bandwidth of the carrier, it just changes the MODCODs so you can get more or less throughput. Benefits and value vary over time and are not guaranteed, but are predictable. ACM essentially converts link margin to an increase in the data throughput of satellite links. When utilizing ACM operation in our products, link margin can be converted into increased throughput of satellite links.

**WAN Optimization** – tools, such as our FX Series, will monitor all of the traffic that comes onto to the network and enable you to perform traffic shaping. Traffic shaping can be particularly useful for backup networks. In the event of a catastrophic failure, you may be willing to give up some of your services, such as data, to ensure that you have essential voice and signaling services available to your users.



WAN optimization constantly monitors the WAN capacity, working in conjunction with our satellite modems and VMS. In the case of a catastrophic event, the VMS will tell the circuits to shrink by a pre-determined amount so the failed sites can be fit into the network. The FX Series device understands that the WAN capacity has now shrunk. Unfortunately, routers and MSC switches don't understand changing capacities. So, the router or MSC switch feeds more traffic than the circuit can now handle. This is where the FX Series comes into play. It ingests all of the traffic, labels it, sorts it, and prioritizes it based on a variety of criteria or rules. Once the traffic has been filtered to put it into different priority classifications, it is drained based on established rules. The result is a system that grabs less capacity than would normally be needed to backup the site with prioritization to ensure that the most important traffic is transmitted.



**Integrated Network Management** – our NetVue™ Integrated Management System is a powerful and scalable network management platform designed to seamlessly manage satellite networks. It provides a unified management interface to monitor, control, and obtain status for Comtech EF Data and other third-party products. The intuitive, web-based GUI presents the managed network in multiple views, providing real-time data gathering, trend analysis, alarm management and notification. It also offers advanced applications for automation, scheduling, event correlation, reporting, access via mobile devices and spectrum analysis. NetVue servers may be setup as stand-alone, in 1:1 redundant configuration or clustered in a manner that allows multiple locations to be part of a single cluster for redundancy and simplified user management and security.

NetVue's flexibility and scalability make it an ideal management platform for small, medium and large networks. Its simplicity and ease of use enables operators to manage networks efficiently and cost effectively, to manage SLAs and to provide superior customer experiences.

### ***Automate Capacity Usage***

Once you have all of the tools in place, there are various methods to automate the capacity usage. Let's examine a couple brief examples.

- **Semi-Automated / Manual Outage Restoral System** – with this approach, the NOC personnel would be notified via call or alarm that one of the terrestrial cables is down and that backup services are required. The operator would utilize the M&C system (NetVue) to select which site is down and initiate the satellite backup link. This triggers the VMS to examine the available satellite capacity to find the best fit. VMS then puts up the circuit, tears down the old circuits, etc. This is a very simple process that just requires the operator to connect into the network management system for a matter of seconds.
- **Automated Outage Restoral System** – our M&C system (NetVue) can take commands and controls from other M&C systems or devices. Should there be a failure on a fiber/cable link, the site's M&C system can see that the link has failed. The site's M&C system sends a Machine-to-Machine message to our M&C system that indicates there is an outage at a specific site, and the backup capacity for that site will be brought up. Without any operator intervention, the satellite link will be established for the capacity needed by the site.

### **Summary**

The more sites that need satellite restoration, the more you can aggregate and do a probability analysis. With multiple sites, our solution is very scalable and powerful, enabling you to secure a small satellite bandwidth contract and still have a completely automated backup for all of your terrestrial links at a network availability figure your customers expect.

For additional information, contact us. Our experts are ready to assist you in determining how to best establish an automated, flexible and cost-effective satellite-based restoral solution.

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