# Via Satellite's
Tech Focus
REPORT

From IP to RF: Improving QoS With End-to-End Management

As networks get bigger and more complex they become more powerful, however their points of failure also multiply. Problems become harder to diagnose and bandwidth becomes more difficult to manage, especially when transmission methods converge, such as terrestrial copper and fiber with microwave and satellite links. That's no secret, of course, but when a customer loses signal during the final minutes of the World Cup they don't care whether the breakdown was in the RF or the IP leg.

Denver

New York

Atlanta

Miami

Santa Clara
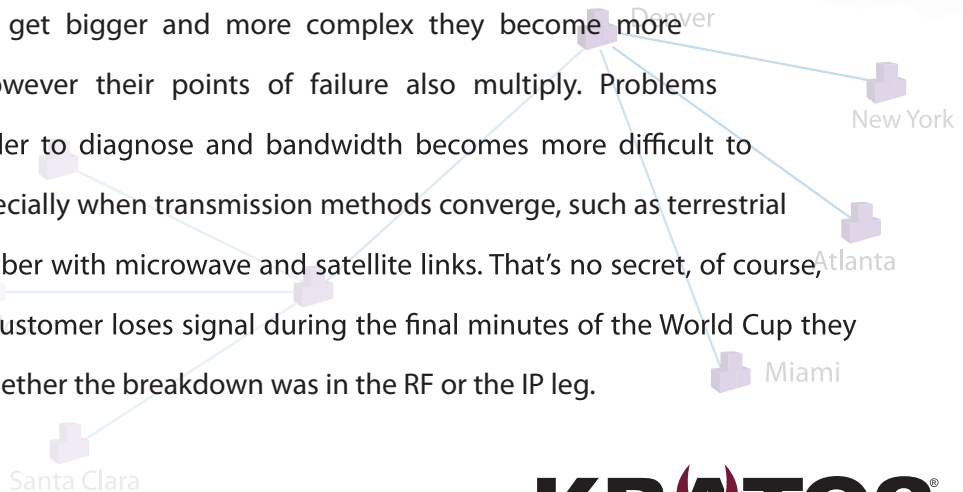
KRATOS®

The Changing Face of SATCOM Management

Traditionally, SATCOM networks have been isolated islands operated and managed independently of associated terrestrial-based transport networks. Even the SATCOM network itself is fragmented, with VSAT networks operating on proprietary systems, carriers on standalone CSMs, antenna RF on separate M&C systems and remote, unmanned endpoints often not managed at all.

This may have been acceptable when SATCOM networks were smaller, standalone systems without strict SLAs, however, today satellites are becoming just one of many transport mechanisms in a much larger network of networks. Organizations are seeking broader system visibility in order to:
· Maximize network utilization and value.
· Deliver effective management of network resources and satellite bandwidth.
· Expedite transmission set-up and system recovery to maximize network revenue.
· Eliminate the time SATCOM operators waste searching for problems that are actually in the terrestrial network, and vice versa.

Historic Challenges to Effective End-to-End Management

Terrestrial and SATCOM network operations can be very different. That's one reason the convergence of management systems has lagged behind the convergence of technologies. The types of data each monitors is different, as are the protocols, instrumentation, all the way down to the terminology.

Take bandwidth usage for instance. For managers of satellite resources, key performance indicators include EIRP, Eb/No and BER; for the IP manager bandwidth is about latency and packet loss. All five factors directly affect service levels and should be managed as an end-to-end process to realize the full revenue potential of the network. This makes one of the key challenges not just the sharing of data, but also its fusion into a meaningful operational picture for effective decision-making.

The other key obstacle has been cost. Most organizations—especially those that incorporate a satellite or microwave segment— have come to rely upon a growing number of stovepiped tools for monitoring an array of systems and subsystems. Any organization seeking a unified management picture has been forced to undertake a one-off integration project that is expensive, time consuming and frequently risky given the fast pace of technology change.

Kratos has solved both challenges with a suite of integrated, commercial-off-the-shelf (COTS) products that bridges islands of management, streamlining disparate operations at a fraction of the cost of custom solutions.

A Scalable, Economical E2E Solution

Kratos has developed the first COTS solution for end-to-end (E2E) management that collects data, correlates alarms and automates control across satellite and terrestrial network segments. E2E management is the ability to assure the availability, reliability and security of communications between distributed end points across heterogeneous transports— whether that's two users on a video conference or many-to-many end points, such as the numerous event venues at the Olympics broadcast over multiple satellites to millions watching around the world.

The Kratos E2E Management Suite is based upon three market-leading products united by an architecture that incorporates distributed data collection, abstraction, integration, analysis and correlation. The pillars of the suite are:
· COMPASS, used by thousands of organizations for monitoring and control (M&C), especially of RF, microwave and other non-IP equipment
· Monics®, the industry's leading carrier management, signal characterization and interference detection solution, and
· NeuralStar®, the enterprise-class network management product used by some of the most complex and security-conscious networks in the world

Each product is available as a standalone solution for discrete management tasks, and together they operate as a unified E2E platform for situational awareness and systems control. The suite is modular and highly scalable, capable of accommodating new resources. Monics, for example, can monitor a virtually unlimited number of satellite carriers and NeuralStar manages networks as small as one thousand devices to one million elements distributed
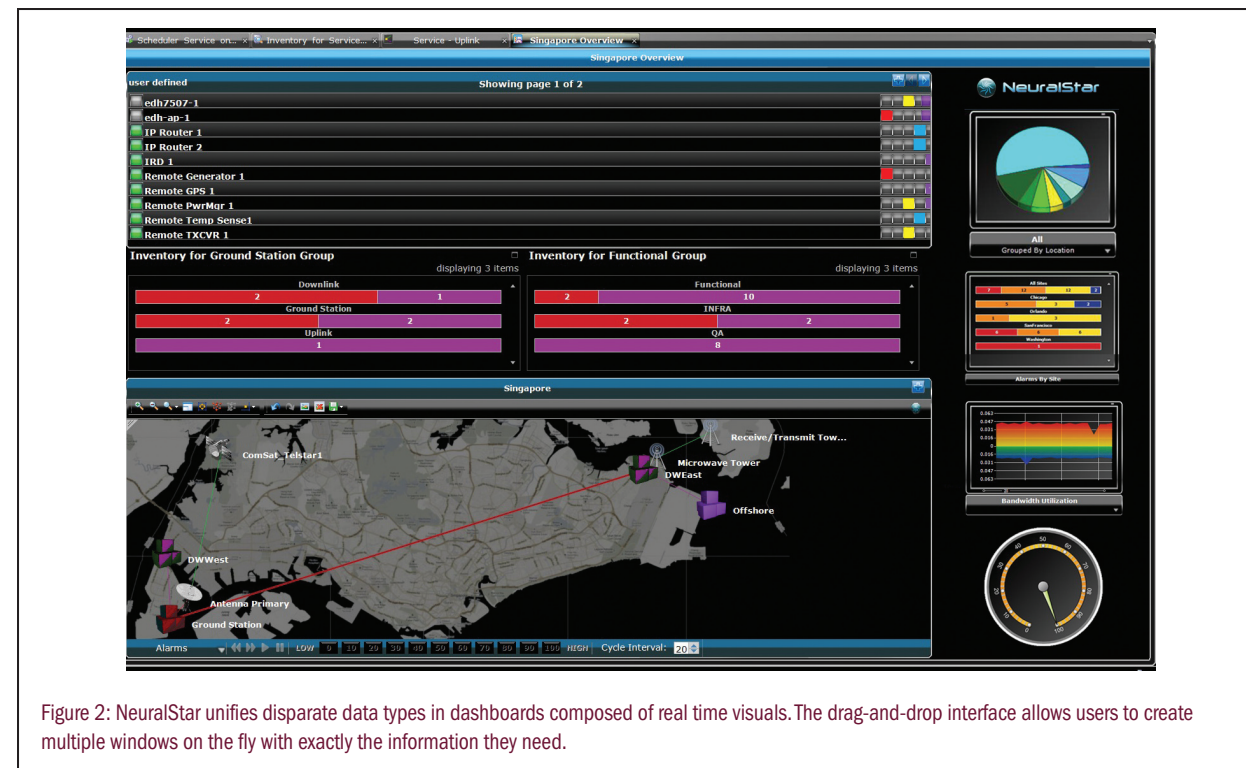

Figure 2: NeuralStar unifies disparate data types in dashboards composed of real time visuals. The drag-and-drop interface allows users to create multiple windows on the fly with exactly the information they need.

worldwide across hundreds of facilities. This architecture allows for ready expansion as missions, networks and organizations grow, making it easy to add new satellite capacity or network facilities without degrading performance or adding support staff.

Monitor, Manage, Integrate and Optimize

As shown in Figure 1, NeuralStar unifies the Kratos E2E Management Suite, directly monitoring IP-based network and IT devices and also serving as a "manager of managers" (MoM) that aggregates and abstracts event data from any network-connected device or element manager. This enables organizations to define their E2E strategies broadly to include RF, microwave and IP communications systems, as well as cybersecurity, physical security, and even infrastructure, such as HVAC, UPS and power systems if they choose. All can be aggregated and included in NeuralStar's unified dashboards with centralized alarming and integrated event management. Almost any relevant data can be added to dashboards including camera and web feeds.

COMPASS directly monitors non-IP devices, feeding NeuralStar and adding automation and control capabilities, including the ability to control resources at unmanned remote satellite sites through its Mercury G3™ component. On one oil pipeline system, for example, COMPASS manages 55 remote microwave radio sites and 450 satellite stations to assure effective transport. Operators miles away can remotely control the system, enhancing reliability and reducing manpower, travel and related costs. These capabilities help operators speed system recovery and head off problems before they can affect service delivery.

The third pillar of the suite, Monics, is the industry-leading carrier monitoring system that provides RF link protection and real time space situational awareness. Monics works with most spectrum analyzers or can be deployed with its own advanced SAT-DSP Digital Signal Process (SAT-DSP) to provide greater power and accuracy for detecting interfering signals and collecting time domain characteristics. COMPASS and Monics work together to enhance QoS by enabling automation between carrier management and ground station equipment. For example, satellite operators can automate uplink power control by using Monics to monitor carriers and quickly ramp up transmitter power or adjust modem Eb/No when rain fade or other conditions exist.

Better Bandwidth Management To Maximize SLAs

To see how E2E management can materially improve operations, consider the earlier discussion of how RF and IP managers approach bandwidth differently. Providers must understand peak periods on both sides of the network in order to maximize revenue and profits by pro-actively scheduling services over limited transponder and network assets. Otherwise, over-subscription results in missed SLA objectives and under-subscription raises operational costs per service. By bringing together all relevant metrics from across the transport systems— EIRP, Eb/No, BER, latency, packet loss and more— into a single overall services view, operators can act in real time to recognize and react to bottlenecks regardless of location. They can:
· Take advantage of non-peak periods and under-utilized assets to route non-essential services during off periods.
· Recognize when weather or interfering carriers affect the packet loss and degradation on the IP network.
· Automatically re-route traffic when congestion issues arise.
· Pro-actively address the effects of increased satellite latency on the TCP network when caused by poor conditions or adjacent/interfering carriers.

Workflows That Enhance Productivity

The Kratos E2E Management Suite can improve service quality in other ways as well, particularly through workflows that reduce
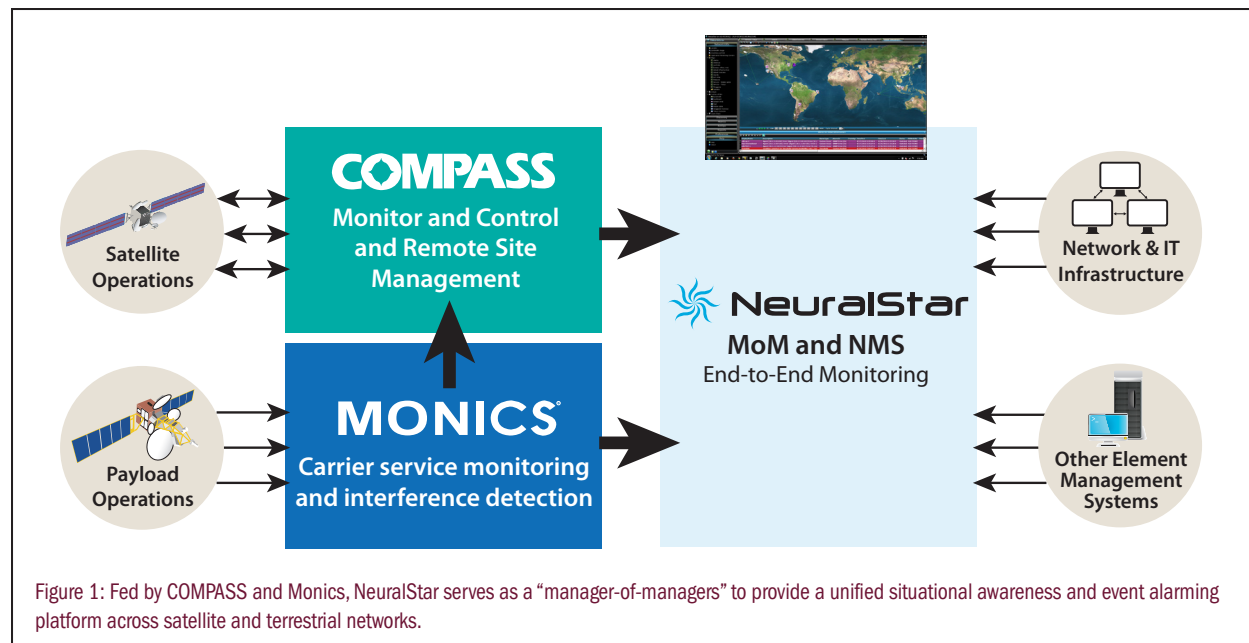

Figure 1: Fed by COMPASS and Monics, NeuralStar serves as a "manager-of-managers" to provide a unified situational awareness and event alarming platform across satellite and terrestrial networks.

costs and increase productivity. For example, Kratos has worked with leading planning system vendors to streamline and automate the process of allocating bandwidth and scheduling non-essential services during peak times. When a new service request is added into the planning system, data automatically flows to Monics which immediately adds the new carrier to the monitoring plan and begins monitoring the new service. Also notified by the planning system, COMPASS automatically sets up the RF equipment needed for the service. Together, Monics and COMPASS automate the uplink power control and related processes. Operators immediately receive validation that the service has been properly set up and NeuralStar automatically begins collecting data from COMPASS, Monics and applicable VSAT management systems for overall reporting and a real time picture of service availability and performance.

Setting up a service chain like this can involve many hardware and software systems each with its own element manager, which operators. historically. have had to learn and navigate between. By enabling operations to function at the service layer, rather than each element individually, Kratos E2E management and automation allows operators to provision the new service far more quickly and to immediately begin managing it alongside other services. Carrier interference, a common problem during transmission setup, can also be handled far more swiftly, and maritime, airborne or mobile services can be configured more easily.

Faster Root Cause Identification

Typical network and element management products create a long list of alarms which are difficult to sort through and isolated from other relevant data, such as cybersecurity or physical infrastructure information. They often miss failures caused by gradual degradation of a device that might have otherwise been recognized through trend analysis. In contrast, with an E2E solution for service level correlations and alarm viewing, operators can recognize, flag and recover high priority services more rapidly. Root cause identification is enhanced through correlation of events across the entire network as well as by suppressing unhelpful, redundant or distracting alerts that merely represent symptoms. With an integrated E2E view, operators no longer waste time chasing false alarms, problems outside their domain or multiple people pursuing related alarms.

For example, through correlation and suppression, operators can recognize that carrier alarms in Monics may actually be caused by a failure on a transmitter. Rather than chase it down with the satellite operator, they quickly identify the problem and use COMPASS to recover the transmitter or re-route the service. Conversely, when Eb/No alarms on modems are generated by an interfering carrier, NeuralStar can suppress those alarms and alert the operator about the interference. Instead of wasting time trying to resolve the Eb/No alarms, the operator can characterize the interferer and work with the satellite operator to resolve the real problem.
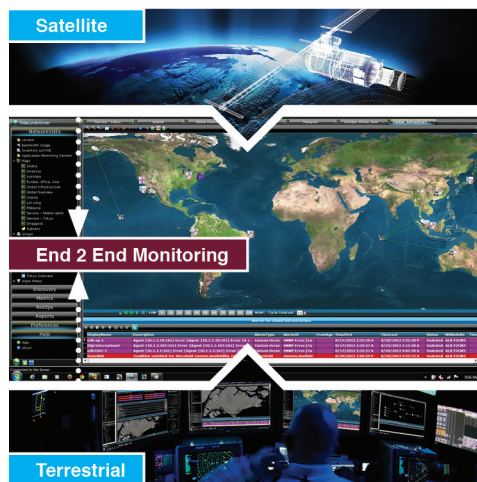
Enabling Global Situational Awareness

The ability of the Kratos E2E Management Suite to consolidate events and correlate alarms makes it a comprehensive tool for global situational awareness and control. Its 360° view across all systems delivers unrestricted visibility and service transparency from source to destination across circuit (satellite/microwave) and packet (IP) networks. Empowered with unified dashboards and reporting that can be optimized for a specific user, service or ConOps, the ability to consolidate systems and eliminate redundant or unnecessary tools and their commensurate training and support costs enhances both effectiveness and ROI. What's more, this picture of true, end-to-end situational awareness enables practical benefits that include:

- Improved service level delivery and more efficient bandwidth management
- Increased QoS through faster problem resolution and heading off problems before they affect service
- Elimination of data stovepipes
- Automated workflows and transmission setup
- Faster root cause identification of problems through centralized alarm management
- Better integration of NetOps, cybersecurity, Information Assurance (IA) and RF link protection
- Maximized SLA by reducing service down-times ■