DoD TELEPORT—NETWORK MANAGEMENT AND CONTROL

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ABSTRACT

The Department of Defense (DoD) Teleport Program integrates, manages, and controls the communications interfaces between the Defense Information System Network (DISN) and satellite communications (SATCOM) assets at a single point of presence. The DoD Teleport Management and Control System (TMCS) provides integrated and automated control functions for satellite Earth Terminals (operating in C, X, Ku, ultra high frequency [UHF], extremely high frequency [EHF], and Ka bands), network and baseband equipment, and other facility-specific items located at a DoD Teleport site. TMCS replaces existing equipment-specific management systems and provides monitoring and control of previously unmanaged equipment, utilizing an open architecture based on commercial standards and nondevelopmental products. TMCS will mature over three generations of DoD Teleport implementation, including integration of other advanced SATCOM systems such as Advanced EHF (AEHF) and Mobile User Objective System (MUOS). This paper provides an architecture and capability overview of TMCS, highlighting its intent to facilitate network operations and control in a SATCOM environment.

INTRODUCTION

With the significant increase of equipment and planned missions for Department of Defense (DoD) Teleport locations, an integrated management system able to minimize the amount of hands-on labor required by personnel is essential. The DoD Teleport Management and Control System (TMCS) provides a nondevelopmental, nondisruptive commercial off-the-shelf product, consisting of hardware, software, and networking components at eight worldwide Teleport sites. Teleport's Generation One TMCS will be fielded in two builds. Build 1 (fiscal year [FY] 2003 and 2004) follows Teleport's Initial Operational Capability 1 (IOC1) implementation: Build 2 (FY04) follows Teleport's IOC2 implementation [6]. The TMCS contract was awarded in FY03 to the team of ITT, Industrial Logic Corporation (ILC), and Dyncorp, utilizing ILC's Maxview management system.

Currently most Teleport equipment is manually configured with minimal automated control leading to time consuming and labor intensive circuit activation. In addition, remote network operations centers responsible for overseeing and allocating equipment assets lack visibility into link and equipment status at these sites. Mission planning that relies heavily on accurate reporting of asset availability may suffer from out of date information. As warfighting becomes more network-centric, a Network Management System at the Teleport that automates configuration and mission planning functions will help ensure a reliable voice, video, and data transport, and ensure those monitoring the war have the complete network picture.

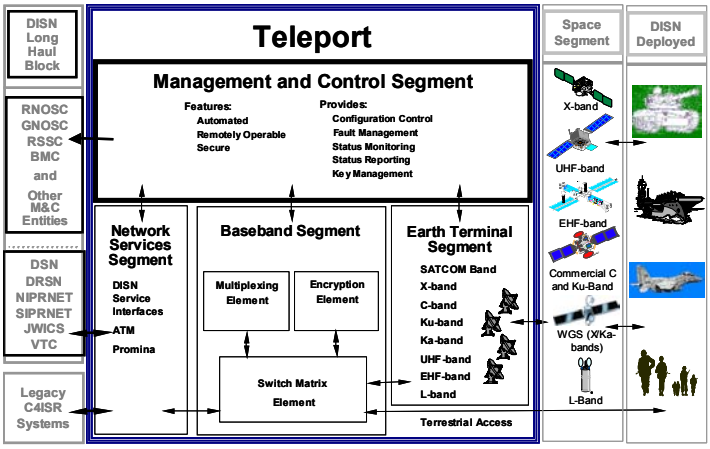

Figure 1. Teleport Functional View

Figure 1 provides a high-level view of how the Management and Control (M&C) Segment interfaces with other functional segments of the DoD Teleport [2]. While existing management systems at communications facilities focus on either the Earth Terminal (ET) Segment or the Baseband/Networking Segments separately, TMCS interfaces with both to provide a complete picture of a satellite link's path to its Defense Information System Network (DISN) destination.

CAPABILITIES

TMCS capabilities consist of the following [1]:

- Resource configuration and automated reconfiguration
- Monitoring and control of Teleport components
- Circuit provisioning
- Macros and macro scheduling
- Event logging
- Customizable graphical user interface (GUI)
    - Logical/Physical circuit views
    - Graphical network representation
- Alarm handling
- System security
- Report generation
- Configuration management
- Centralized status reporting.

TMCS monitors and controls a wide range of communications devices, such as ET hardware (converters, amplifiers, antenna control units, etc.), satellite modems, electronic patching, multiplexers (asynchronous transfer mode [ATM], Promina, Timeplex, Switch Multiplexer Unit), transmission security (TRANSEC) equipment (KIV-19, KIV-7), and test equipment (spectrum analyzers, bit error rate test sets). It provides circuit-level views consisting of the elements that make up the physical equipment string; the overall configuration of those elements; and the configuration of the specific card, port, or interface through which the physical connection flows.

To automate many routine procedures, TMCS provides macro functionality through which the operator groups a set of commands for a collection of devices into a common series of executable commands. Super macros can also be created, combining macros and automated commands with logic and providing the capability for automated reconfiguration. Macros can be scheduled, manually executed by multiple methods, or triggered by the network [1]. TMCS also logs all events (alarms, status changes, user logins) in a searchable database, providing operators with reference data when debugging system outages.

System commands, status, configuration parameters, and analog values are available via a client GUI [1]. Figure 2 shows a sample screen shot of the GUI, providing a graphical layout of a system's ET segment [4]. The GUI graphically depicts the layout of the system and network, from a top-level system view down to specific device views (including to the card/port/channel) all while allowing multiple overlays of views.

TMCS automatically responds to reports of faults, generating both audible and visual alarms, triggering events, and recording failures to log files. It allows the operator to define characteristics of major and minor alarms [1]. Customization on a circuit-by-circuit basis to establish priorities is available to give the operator added flexibility.

To comply with security requirements, TMCS regulates system access based on privileges and priority levels controlled at the site level. TMCS operates on an unclassified closed network; its only external interface is a Read Only status feed to the unclassified side of the Integrated Network Management System (INMS-U) at the Regional Network Operations and Security Center (RNOSC) [1].

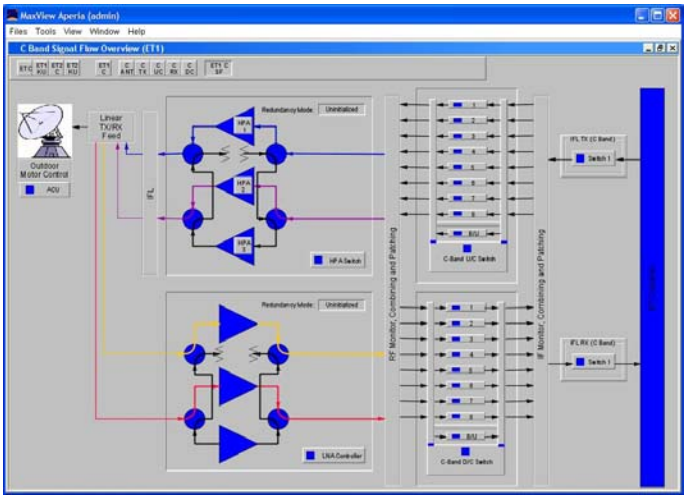

Figure 2. Example GUI Screen Shot

The ability to provide trend analysis helps improve maintenance planning and upkeep of network elements. TMCS generates user-defined reports and is capable of documenting current configurations of Teleport devices and circuits in a configuration database. Maintenance history and device inventory information are kept to ensure that all device hardware and software are tracked throughout their life cycles.

Redundant servers and fail-over applications and services enable TMCS to provide operational availability approaching 100 percent.

ARCHITECTURE

The TMCS architecture consists of a server, distributed clients, distributed communications servers, and a standard SQL database. Clients are located throughout the Teleport site so that the Teleport can be managed from a central console area or at workstations near the equipment. For

example, each ET shelter will have a TMCS client so that operators can check equipment and network status while performing maintenance in the shelter.

As shown in Figure 3, TMCS uses network front end processors (NFEP) to provide network management for satellite communications (SATCOM) and non-network centric equipment, through serial port connectivity [4]. NFEPs are installed near the equipment, distributing network management responsibilities to the locality of the equipment, and are connected by a wide area network/local area network (WAN/LAN). They enable remote control of equipment via TMCS, allowing maintenance tasks, such as troubleshooting with a spectrum analyzer, to be performed in the tech control facility. Management of each device is handled through a multithreaded, real-time polling process on the NFEP. Only changes in state are reported back to TMCS server to reduce overall network loading.

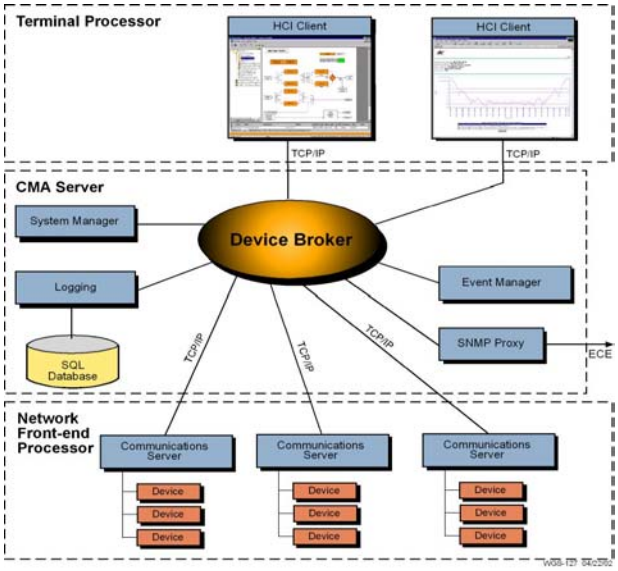

Figure 3. TMCS Architecture Components

To ensure that TMCS maintains settings of all existing equipment in the event of a failure and cutover, the TMCS server uses redundant hardware with critical equipment switchovers [1]. The redundant hardware minimizes interruption of user traffic.

By following the Defense Information Infrastructure Common Operating Environment (DII-COE) and the Joint Technical Architecture (JTA) guidelines, TMCS provides a sustainable, flexible system that can easily accommodate evolving requirements and technology insertion. The DII-COE emphasizes both software/data reuse and interoperability. TMCS complies with the Level 6 DII-COE and the JTA version 3.1.

EXTERNAL INTERFACE

Today's military is moving toward more network-centric architectures. Command, control, and intelligence information is all forwarded to the warfighter by data networks. Sensors and weapon systems connect to remote sensors through similar networks.

Ensuring reliable links to the deployed warfighter is more important than ever. Awareness of the status of these links is also critical to command centers controlling and monitoring a war. TMCS supports this network-centric architecture by providing the status of the transport link to INMS and by allowing automated configuration and reconfiguration of the Teleport circuits.

TMCS provides INMS with status and alarm information for all controllable Teleport equipment through its only external interface. INMS is a remote, higher level network management system located at the RNOSC responsible for aggregating multiple DISN management feeds. INMS benefits from TMCS status data by providing an integrated view of the entire Defense Information Systems Agency (DISA) part of the circuit from the SATCOM piece to the far end DISN point of presence. Circuit outages can now be correlated with SATCOM outages at a Teleport site in the corresponding region. Note that TMCS, via Maxview, is a fully Simple Network Management Protocol (SNMP) manageable application providing the potential for "lights out" management in future Teleport generations.

As shown in Figure 4, the STEP program's information assurance (IA) tool suite provides a secure path from the Teleport site to the RNOSC [5]. At the Teleport, TMCS's Read Only interface terminates at a port of the STEP IA Tools firewall. The data then rides a virtual private network through the Unclassified but Sensitive Internet Protocol Router Network (NIPRNET) to the Regional Computer Emergency Response Team (RCERT) at the RNOSC. The RCERT then provides an interface to the local INMS-U.

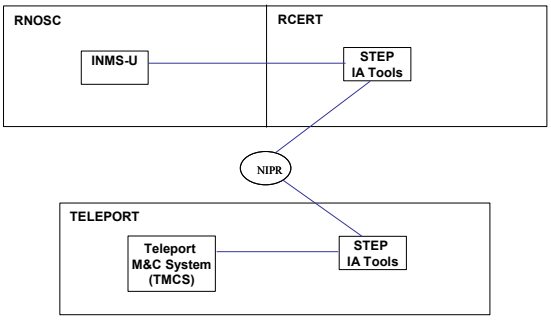

Figure 4. TMCS External Interface

IMPLEMENTATION

TMCS will evolve over three generations of Teleport. During the first generation (FY03–FY05), Builds 1, 2, and 3 will integrate C, X, Ku, UHF, and EHF ET components, as well as a variety of multiplexer, TRANSEC, and test equipment, and will provide the external status interface to the RNOSC. The Teleport sites receiving TMCS during Generation One include Northwest, Lago Patria, Fort Buckner, Wahiawa, Camp Roberts, Ramstein, Landstuhl, and Bahrain.

The Generation Two (FY05–FY06) implementation will integrate the Wideband Gapfiller Satellite's (WGS) fixed Ka-band terminals into TMCS. In Generation Three (FY06–FY10), TMCS will integrate other advanced bands, including Advanced EHF (AEHF) terminals, future wideband systems terminals, and the Mobile User Objective System (MUOS) terminals, and will provide the RNOSC with specific control capability by extending functions to higher level managers [1].

OPERATIONAL BENEFITS

Without TMCS, each Teleport site would consist of multiple, equipment-specific management systems, each designed for a specific element or subsystem. Each of those management systems would require console and rack space, have its own logistics trail and unique software GUI, and require separate training. The super high frequency (SHF) ET systems alone would need separate control systems for the C-band, Ku-band, Ka-band, and X-band terminals. In addition, the X-band system, is undergoing consolidation of multiple controllers into one through a modernization program. This does not even account for UHF and EHF systems. TMCS eliminates the need for multiple terminal-specific ET control systems and provides a standardized GUI for all SHF, UHF, and EHF systems. The GUI, to the greatest extent possible, will be based on the X-band Control, Monitor, and Alarm (CMA) software, with which the operators will already be familiar. Thus, TMCS reduces training and logistics costs by eliminating multiple systems and standardizing on a common GUI.

This same concept of providing a standardized GUI is applied to the baseband and network-centric equipment. For example, Teleport will accommodate multiple vendor ATM switches. Providing a common GUI gives various tasks, from controlling an OC-3 card to building a permanent virtual connection across a switch, the same look and feel to the operator regardless of the underlying switch or vendor hardware.

Because TMCS manages all of the Teleport elements, it provides an integrated platform to monitor alarms and manage circuits. Operators are no longer required to build circuits manually, either through multiple control systems or via multiple front panel configurations. Interactive circuit diagrams assist network operators in circuit configuration, routing, monitoring, and troubleshooting procedures, including circuit status and circuit elements. In addition, TMCS can be configured to take action automatically based on element failures or changes in the state of the network. TMCS also can be configured to automatically solve problems when they occur, such as reconfiguring a circuit or rerouting traffic in response to a failure or based on equipment loading. Systemwide benefits such as these are only feasible because TMCS has integrated management of all Teleport devices into a single system.

SUMMARY

By integrating the management functions of communication devices at a Teleport site, TMCS transforms network operations and control in a SATCOM environment. Reduced hands-on labor, an open and expandable architecture, a single common operator interface, and centralized status reporting all benefit warfighters and planners in the effort to maximize efficiency in tech control facilities. As with most management platforms, the intention for TMCS is to migrate to a lights out facility for Teleport operations. As legacy hardware is phased out and devices transition to the network-centric variety, remote control from a regional facility is more realizable. However, several obstacles remain to the migration to this end state, such as the automation of the crypto key management process and intermediate frequency patching functionality.

In the early phases of TMCS, the goal remains consistent: to fully automate local technical control operations and provide an integrated nodal management capability. The generations of Teleport will allow TMCS to grow in a phased approach to meet emerging warfighter requirements.

REFERENCES

[1] DoD Teleport Management and Control Segment Specification Generation One SR-140, DISA NS7, May 2003.

[2] DoD Teleport System Specification Generation One SR-100, DISA NS7, March 2002.

[3] DoD Teleport Operational Requirements Document (ORD), 31 July 2000.

[4] ITT Teleport Management and Control Segment Briefing, Government Kickoff Meeting, 27–28 February 2003.

[5] TMCS Kickoff Meeting, Briefing, SPAWAR PEO C4I, 27 February 2003.

[6] Statement of Work for the DoD Teleport Management and Control Segment Generation 1, 19 May 2003.