SNMP Management of KIV-19s using the

TELEGRID KIV-19 Remote SNMP Proxy (KRSP™)

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ABSTRACT

Modern Network Management Systems (NMSs) utilize the Simple Network Management Protocol (SNMP) to perform monitor and control (M&C) functions of devices and equipment in communications installations. To support this functionality, most of today's advanced communications and networking products include a built-in SNMP agent and provide a Management Information Base (MIB). The SNMP agent acts as the interface between the managed device and the NMS. The MIB, integrated into the NMS, defines the set of objects in the managed device that are monitored and controlled by the agent. Legacy devices, on the other hand, rarely have a built-in SNMP capability and in most cases do not even have an Ethernet port to facilitate a connection to the NMS. Consequently, legacy devices are often left out of automated NMSs and are relegated instead to manual monitor and control by operations personnel. This not only increases operating costs due to the need for additional personnel but also degrades overall performance by adding time delays to alarms and fault conditions that would otherwise be instantaneously detected by an automated NMS. A proven solution to this problem is to use an external custom SNMP agent and to provide a custom MIB that would allow full integration into any NMS. This paper describes one product in a family of TELEGRID products developed specifically to support the ubiquitous KIV-19/KIV-19A Trunk Encryption Device (TED). This product, called the KIV-19 Remote SNMP Proxy (KRSP™), was developed for the US Army CECOM and is deployed in the tactical Network Operations Vehicle (NOC-V). The KRSP™ agent is fully SNMPv1 compliant in accordance with RFC 1157 (SNMPv3 compliance will be available on December 15, 2006). The KRSP™ agent and MIB are fully compliant with SMIv1 (Structure of Management Information) in accordance with RFC 1155. The KRSP™ can be easily modified to accommodate other legacy devices as needed.

1. INTRODUCTION

Network management technologies and Network Management Systems (NMSs) have made considerable progress in the last few years in managing equipment and systems that are part of small and large communications assemblages. In no other place is this more

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prevalent than in military and Government communications sector where network-centric operations philosophy is being applied across the board. In that arena the benefits of highly networked Command, Control, Communications, Computers and Intelligence (C4I) systems have been fully recognized and are being pursued aggressively. Consequently, modern and future tech-control facilities, Tactical Operations Centers (TOCs) and Command Posts (CPs) will reflect this philosophy by allowing full visibility and full control of all equipment and systems and by automating many of the functions performed today by trained personnel.

A key technology used in performing the monitor and control (M&C) functions in NMSs is the Simple Network Management Protocol (SNMP). SNMP is the networking protocol used for communications between the NMS and managed devices. It is part of the TCP/IP suite of Internet-standard protocols and is defined in RFC-1157.

Most of today's advanced communications and networking products have a built-in hardware/ software SNMP agent which forms the physical and lower level interface between the device and an NMS. These products also include a Management Information Base (MIB) which defines the set of objects that the SNMP agent can monitor and control. The MIB is designed to be loaded onto and becomes part of the NMS.

Legacy devices and equipment, on the other hand, do not have built-in SNMP agents and do not include a MIB. In most cases they do not even have the physical Ethernet port to allow them to connect to the NMS's Local Area Network (LAN). For these devices special steps must be taken in order to support this capability externally. These steps involve the used of an external product which includes a custom SNMP agent and a custom MIB.

One such legacy device is the KIV-19/ KIV-19A Trunk Encryption Device (TED), herein referred to as KIV-19. This product has been used universally for many years by military and Government organizations to encrypt serial data streams in various communications links at rates up to 13 Mbps. Since the KIV-19 was developed prior to the age of networking and SNMP, it does not have a built-in agent or the capability to be incorporated into a modern NMS. As a result, KIV-19s are often left out of automated NMSs and are relegated instead to manual monitor and control by operations personnel. This not only increases operating costs due to the need for additional personnel but also degrades overall performance by adding time delays to alarms and other fault indicators that would otherwise be instantaneously detected by an automated NMS. In large installations where large banks of KIV-19s are used to service numerous communications links the situation becomes even more severe.

TELEGRID developed the KIV-19 Remote SNMP Proxy (KRSP^{TM}) specifically to address these KIV-19 shortcomings. The product includes a hardware SNMP agent which connects to several KIV-19s and has full visibility of all the available KIV-19

monitor and control functions in each device. The KRSP™ also includes a MIB that allows incorporation into any commercial NMS. For stand-alone applications, the KRSP™ includes a software manager which, when loaded onto a laptop or workstation, functions as a complete stand-alone NMS with a full Graphical User Interface (GUI). The KRSP™ was developed for the US Army CECOM and is deployed in a tactical environment in the Network Operations Vehicle (NOC-V). In that configuration the KRSP™ also monitors other non-SNMP devices such as three (3) Uninterruptible Power Supplies (UPSs) and a Temperature/ Humidity Sensor.

TELEGRID's family of KRSP™ includes several different models as shown in Section 4. This paper focuses on KRSP™ Model RSP-116 which supports up to sixteen (16) KIV-19s as shown in Figure 1 below.

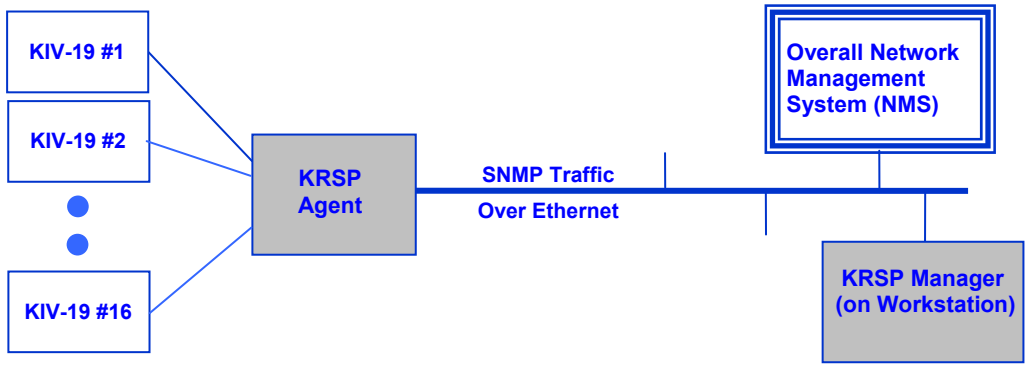

Figure 1 - TELEGRID KRSP™ Model RSP-116 Architecture

2. KRSP™ CAPABILITIES

The KRSP™ Model RSP-116 manages up to sixteen (16) KIV-19s simultaneously. Each KIV-19 connects directly to an individual DB-15 connector on the rear panel of the KRSP™ agent. The pinout of each connector has a one-to-one correspondence to the pinout of the DB-15 CONTROL connector on the rear panel of the KIV-19 Mounting Rack. This allows a simple straight-through ribbon cable to be used to interconnect the two devices.

For each KIV-19 the KRSP™ monitors the following four signals which are accessible on the CONTROL connector of the KIV-19 Mounting Rack:

POWER ON
ALARM
FULL OPERATION

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RESYNC ACHIEVED

Changes in these signals are detected by the KRSP™ agent and reported to the NMS using SNMP traps. The NMS can also request the status of these signals using SNMP Get queries.

For each KIV-19 the KRSP™ agent invokes the following four commands which are accessible on the CONTROL connector of the KIV-19 Mounting Rack:

RESTART
ZEROIZE
CHANGE KEY
RESYNC

These commands are issued in response to SNMP Set queries issued by the NMS. The KRSP™ agent's front panel includes a switch which can disable commands received from the NMS in order to enhance system security.

A KRSP™ agent can be managed by up to five (5) separate remote NMSs that are registered with the agent as valid managers during the set-up process. Agents only communicate with managers that have been registered as valid managers. The agents' security protocol will drop all packets arriving from managers which are not on the valid manager list.

3. KRSP™ COMPONENTS

The KRSP™ includes a hardware SNMP agent and a MIB used to incorporate the KIV-19 into any NMS. The KRSP™ also includes a software stand-alone manager that can be loaded onto a laptop or workstation to allow stand-alone management of devices when a fully functional NMS is not being used.

3.1 The KRSP™ Agent

The KRSP™ Model RSP-116 SNMP agent is housed in a 1U small form factor chassis. The rear panel of the agent has sixteen (16) DB-15(F) subminiature connectors that accommodate connections to the KIV-19s. It also has an Ethernet RJ-45 connector that interfaces to the NMS LAN. The physical layer interface is Ethernet 10/100Base-T.

The KRSP™ agent enclosure is constructed from 0.060 inch Aluminum material and has the dimensions of 17.25 inch X 12.00 inch X 1.70 inch. The front panel of the Agent is composed of 0.120 inch Aluminum material and has the dimensions of 19.00 inch X 1.70 inch. These dimensions constitute a 1U rack space.

The front panel of the KRSP™ agent contains the following switches, connectors and indicators:

POWER Switch

Used for controlling power to the internal agent's electronic circuitry.

CONSOLE Port

A DB-9(F) subminiature connector used during agent's configuration.

COMMAND ENABLE Switch

A toggle switch used to disable sending commands to the KIV-19. Monitoring of the KIV-19 signals is not effected by this switch.

Space for Agent ID

A white area allotted for entering an agent's name or number used to identify it to the manager.

The rear panel of the KRSP™ agent contains the following switches and connectors:

KIV-19 Connectors

Sixteen DB-15(F) connectors used to connect up to sixteen KIV-19s to the KRSP™ agent.

Ethernet Port

An RJ-45 connector used to connect the Agent to the Ethernet LAN of the NMS.

RESET Switch

A recessed push-button switch used to reset the agent to its factory default state.

The KRSP™ agent operates from AC power input of 90-264VAC 47-63 Hz. Other input power options are available.

3.2 The KRSP™ MIB

The KRSP™ Model RSP-116 MIB defines a set of objects which the NMS can use to monitor and control up to sixteen (16) KIV-19s. The MIB explains what each object is and how the NMS can use these objects to not only obtain a full picture of the status of a device but also to control the device. The objects are termed Object Identifiers (OIDs) and are paired with a typed variable to create a Variable Binding (Varbind). The Varbind is used in all SNMP messages to request and receive specific information about each object contained in the MIB. For example, the defined KIV-19 objects include: KIV-19 ALARM status, FULLOP status, etc. These objects are arranged hierarchically into the rows of tables such that each row represents a unique set of objects for each managed KIV-19. Additionally the MIB defines a set of objects used to monitor and control the KRSP™ agent itself. For example, these defined objects include: agent's IP address and subnet mask, list of valid managers, etc.

All objects are defined for maximum usability in the NMS. Rigorous definitions are set for each object in the MIB, which fully characterize how the objects are to be used and what responses the NMS should expect from the KRSP™ agent. This eliminates all guesswork as to how the KRSP agent behaves and allows the Network Administrator (NA) to set up simple rules to process the information that the KRSP™ agent provides. This allows not only ease of use, but straightforward integration into any NMS.

The MIB is fully compliant with the Structure of Management Information Version 1 (SMIv1, RFC 1155) and will compile error-free into the MIB database of any NMS.

3.3 The KRSP™ Stand-Alone Manager

A stand-alone manager is provided with the KRSP™ Model RSP-116 for situations where no other NMS is used. Several agents can be supported by a single stand-alone manager. The manager, designed to reside on a laptop or workstation, includes a Graphical User Interface (GUI) that provides the operator with full network management functionality. The GUI is designed to resemble a Windows-style desktop. Agents, and their associated monitored devices, are displayed as icons on the desktop with devices displayed hierarchically under their respective agent. These icons are color-coded to indicate the device's current status. The GUI presents the operator with an "at-a-glance" view of all agents and managed devices, allowing for immediate error identification and a vehicle for quick response.

The KRSP™ stand-alone manager automatically organizes system information first by agent and then by managed device. The GUI allows for one-click access to Get/Set data, performing all lengthy SNMP operations in the background. This information is presented graphically, avoiding the need to decipher long OIDs or to decode traps or responses to queries.

4. SUMMARY

The TELEGRID KRSP™ family of products provides the capability of incorporating KIV-19s into any commercial NMS. It does that through an external SNMP agent and a MIB that were custom-designed to manage several KIV19s simultaneously. The KRSP™ Model RSP-116 discussed in this paper supports up to sixteen (16) KIV-19s. It allows them to be automatically managed by an NMS thus eliminating the need for on-site monitor personnel and speeding up the response to alarms and fault conditions. The 1U small form factor chassis of the KRSP™ agent supports easy installation in a KIV-19 rack and the connectors' configuration allows for simple cable connections between each KIV-19 and the KRSP™ agent. The internal architecture of the KRSP™ supports easy customization in order to accommodate other legacy devices that may have to become part of the NMS. The following KRSP™ models are available:

1. **KRSP™ Model RSP-100** manages 3 KIV-19s, 3 UPSs and a Temperature/ Humidity Sensor in a 1/3 U chassis.
2. **KRSP™ Model RSP-104** manages 4 KIV-19s in a 1/3 U chassis.
3. **KRSP™ Model RSP-116** manages 16 KIV-19s in a 1 U chassis.
4. **KRSP™ Model RSP-704** manages 4 KIV-7s in a 1/3 U chassis.
5. **KRSP™ Model RSP-716** manages 16 KIV-7s in a 1 U chassis.

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