

**APPENDIX 5**  
**DOD GENERIC SWITCHING CENTER REQUIREMENTS (GSCR)**  
**08 SEP 2003**  
**DSN Switch SONET Digital Trunk Interface**

**A5.1 Background**

This appendix describes the requirements that must be met by all switch SONET Digital Trunk Interface (SDTI) for them to be certified and used in the Defense Switched Network (DSN).

The requirements contained in this appendix are based on:

- a. Policy for DOD voice networks as outlined in the Chairman of Joint Chiefs of Staff Instruction (CJCSI) 6215.01B, *“Policy for Department of Defense Voice Networks”*. CJCSI 6215.01B defines the DSN as being “an interbase, nonsecure or secure C2 telecommunications system that provides end-to-end command use and dedicated telephone service, voice-band data, and dial-up VTC for C2 and non-C2 DOD authorized users in accordance with national security directives.” The CJCS instruction further specifies the need for the DSN to offer military unique features (MUFs) such as Multi-Level Precedence and Preemption (MLPP) and Network Management (NM).
- b. *“Department Of Defense Voice Networks Generic Switching Center Requirements (GSCR)”*, 08 Sep 2003.
- c. Department of Defense Instruction (DODI) 8100.3, 16 January 2004, *“Department of Defense (DoD) Voice Networks”*.

**A5.2 Purpose**

The purpose of this appendix to the Defense Switch Network (DSN) Generic Switching Center Requirements (GSCR) document is to specify the switch SONET Digital Trunk interface requirements so they can be certified for use in the DSN.

Switch digital trunk interfaces are used for bandwidth efficiency and utilization of higher density carrier systems and for reducing the need for individual DS1 switch termination hardware and software.

With the rapid growth of optical fiber transmission facilities, it has become appropriate to describe generic requirements for a high-capacity digital switch trunk interface. A high-capacity trunk interface on the digital switch that is compatible with Synchronous Optical Network (SONET) allows interconnection with SONET Network Elements (NEs). SONET defines Optical Carrier 3 (OC-3) signals and their equivalent electrical Synchronous Transport Signals (STS-N). These signals operate at a rate of  $N \times 51.840$  Mb/s. The SONET digital switch trunk interface provides a direct termination of fiber optic transmission systems. The synchronous optical OC-3 ( $N \times 51.84$  Mb/s) digital switch interface permits termination of  $N \times 28$  Virtual Tributaries (VT1.5s). The SONET digital switch trunk interface transmits an OC-3 (or STS-N

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signal) containing VT1.5s. These VT1.5s may terminate at another SONET digital switch interface, or they may terminate on a SONET multiplex that outputs Digital Signal Level 1 (DS1) to an existing DS1 switch interface. SONET is a transmission network constructed as a progressive hierarchy of synchronously inter-leaved tributary signals.

The rapid growth in the deployment of transmission facilities at DS3 and higher rates provides motivation to seek efficient ways of handling these high-speed signals in the central office. A high capacity digital switch interface, such as the SONET digital switch interface, will be integral to defining the future DSN network architectures that are intended to make efficient use of transmission facilities and offer potential for new services. However, because the current, typical switch-to-switch cross-section is smaller than the capacity of an OC-1, additional transmission equipment such as a SONET Add-Drop Multiplex (ADM) and Wideband Digital Cross-connect System (WDCS) may be required to build up suitably sized bundles for the high-capacity switch termination. The value of N for an efficient high-capacity OC-3 signal termination on the SONET digital switch interface depends on the evolution of SONET. Also, different vendors may have different switching architectures that may be optimized for different OC-3s. Because the current, typical switch-to-switch cross-section is smaller than the capacity of an OC-1, a high-capacity OC-N signal, with N greater than 3, may be under-utilized and inefficient to terminate on the digital switch.

As a minimum, compliance to Section 1 of the GSCR is required to include this appendix requirements that are features and capabilities considered necessary for a particular switch type to support Warfighter missions in DoD. These features and capabilities will require certification prior to introduction into the DSN.

Conditional requirements are features and capabilities that are not considered critical for DoD mission support based on DoD policies. It is however, recognized that such features do have utility for some users or for specific operations. To ensure interoperability and consistency of the Multi-Level Precedence and Preemption (MLPP) functionalities across all platforms, these features and capabilities are specified with set parameters. If these features and capabilities are provided, the device shall perform and meet the specifications as identified in this GSCR appendix.

### **A5.3 Applicability**

This appendix applies to all switch SONET digital trunk interfaces procured or leased for installation in the DSN. All services, features and functions (both unique military and standard commercial) identified in this GSCR and associated Appendixes are to be implemented in DSN SONET Digital Trunk Interface. This specification also applies to upgrades and new software loads for existing SONET Digital Trunk Interface equipment.

This Generic Switching Center Requirements (GSCR) appendix complies to the Telcordia Technologies GR-782-CORE, “*SONET Digital Switch Trunk Interface Criteria*”, Issue 1 June 2000 for an OC-3 (or STS-N) interface to a Digital Switching System (DSS) to be used in the DSN trunk networks. The typical SONET digital switch interface functions are described as pertaining to the DSN intraoffice environment. The DSN intraoffice environment is viewed as a

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facility that contains at least one DSN center. Unless otherwise specified, it is assumed that the SONET digital switch interface is in the intraoffice environment. An interoffice SONET digital switch trunk interface is optional. It is assumed that, most of the time, the SONET digital switch trunk interface will be connected to an ADM or WDCS in the same office, via an intraoffice connection. It is further assumed that the majority of the performance monitoring will be done within the transport network (i.e., at ADMs and WDCSs). Thus, for an intraoffice connection, the switch interface unit will not need to process several of the overhead bytes because they will have already been processed by an ADM or WDCS before the signal arrives at the switch. Therefore, this GSCR Appendix takes into account two switch interface types: an intraoffice interface and an interoffice interface, where the latter processes the overhead as in the transport network. This document complements Telcordia Technologies GR-253-CORE, "*Synchronous Optical Network (SONET) Transport Systems: Common Generic Criteria*", Issue 3, September 2000 which describes the SONET signal hierarchy and formats, that includes common criteria for the SONET digital switch interface and other SONET network elements. Therefore, common criteria are referenced in GR-253-CORE, and are not repeated in this appendix unless it is considered to be a part of the required MUF features and functionalities. The criteria for the interoffice switch interface comply with GR-253-CORE however, the criteria for the intraoffice switch interface differ from GR-253-CORE because the switch interface is not addressed as a transport device. This GSCR Appendix, which addresses the SONET interface for the trunk side of a digital switch, is distinct from Telcordia Technologies GR-303-CORE, "*Integrated Digital Loop Carrier System Generic Requirements, Objectives, and Interface*", Issue 4, December 2000.

The GSCR is the governing specification document that takes precedence over the explicit or implicit requirements of subsidiary or reference documents, standards, and specifications. In the event of conflict, the explicit requirements of the GSCR take precedence over the explicit or implicit requirements of the LATA Switching Systems Generic Requirements (LSSGR), Generic Requirements (GR), and DISAC 370-175-13.

### **A5.4 Definitions**

**Required:** These are features and capabilities considered necessary for devices covered by this appendix for DoD mission support based on DoD policies. These features and capabilities require certification prior to introduction into the DSN.

**Conditional:** These are features and capabilities that are not considered critical for DoD mission support based on DoD policies. It is recognized however, that such features do have utility for some users or for specific operations. If these features and capabilities are provided, the devices covered by this appendix shall perform and meet the specifications as identified.

### **A5.5 Requirements**

This section provides the requirements for switch SONET digital trunk interfaces in the DSN. All switch SONET digital trunk interfaces are required to meet the below requirements.

#### **A5.4.1 Military Unique Features**

**[Required]** The features and functions identified in this document shall support the full complement of MUFs to include Channel Associated Signaling (CAS), Integrated Services Digital Network (ISDN) NI-1/2, and DSN backbone using Common Channel Signaling 7.

#### **A5.4.2 Interface**

**[Required]** The SONET interface shall be in compliance to GR-303-CORE for an OC-3 interface between an Integrated Digital Loop Carrier (IDLC) system's remote digital terminal and the line side of a local digital switch.

**[Required]** The SONET interface shall meet the requirements of GR-253-CORE and GR-782-CORE.

**[Required]** The criteria for the various SONET optical and electrical interfaces shall conform to GR-253-CORE. Such an interface shall also comply to GR-303-CORE.

**[Required]** The SONET digital trunk interface shall, as a minimum, comply to ANSI T1.105-2001, "*Synchronous Optical Network (SONET) - Basic Description including Multiplex Structure, Rates, and Formats*".

**[Required]** All features and functions that are defined in the GSCR to operate at a DS1 rate shall work transparently at the VT1.5 rate over the SONET interface.

**[Required]** SONET digital interface shall support provisioning of transport levels as low as the DS1 rate for separately grouping of various categories of traffic such as voice, data, satellite, and terrestrial transmission.

**[Required]** The SONET digital switch trunk interface shall be capable of DS0 call processing and routing and shall route the DS0s within a VT1.5 in a way that presents the DS0s to the DSN for processing.

#### **A5.4.3 ROUTE Assignment**

**[Required]** SONET digital trunk interface shall support "ROUTE" assignment of trunk group(s) at the OC-3 (highest) and down to DS0 (lowest) rates as defined in Section 4.2 of the GSCR and shall support the signaling requirements as defined in Table 1-3 of the GSCR.

#### **A5.4.4 Facility Alarms**

**[Required]** SONET digital trunk interface shall provide maintenance signals that include the following failure states as defined in GR-253-CORE for loss of signal, loss of frame, loss of pointer, and equipment failures.

- Line AIS.

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- Line FERF.
- STS Path AIS.
- STS path Yellow.
- VT Path AIS.
- VT path Yellow.

Code processing is necessary for all applications for maintenance related activities.

**[Required]** SONET digital trunk interface shall conform to Section 7.2 of GR-782-CORE for AIS and Yellow signal processing to include signal processing for rates as low as DS1.

**[Required]** SONET digital trunk interface shall process DS0 AIS and transmit DS0 RAI (Yellow) in accordance with GR-253-CORE.

### **A5.4.5 Synchronization**

**[Required]** SONET digital trunk interface shall meet the common synchronization requirements specified in GR-253-CORE and GR-518-CORE, “*LSSGR: Synchronization Section 18*”, Issue 1, May 1994, and GR-436-CORE, “*Digital Network Synchronization Plan*”, Issue 1, June 1994, Revision 1, June 1996.

**[Required]** SONET digital trunk interface shall meet the Sinusoidal Jitter Tolerance requirements specified in GR-253-CORE. The SONET digital switch interface falls under Category II in GR-253-CORE.

**[Required]** SONET digital trunk interface shall meet the Jitter Generation requirements specified in GR-253-CORE.

**[Required]** SONET digital trunk interface shall meet the generic Wander requirements per GR-253-CORE, and shall be able to accommodate at least 10- $\mu$ sec of wander over a 24-hour period (the maximum amount of wander expected to appear at these interfaces).

**[Required]** As defined in Section 6.6 of GR-782-CORE, the 24 DS0 (VT1.5) signals not using out-slot signaling shall have an all “zeros” idle code inserted into the appropriate signaling bit positions within the VT1.5 stream. A mixture of DSN CCS and out-slot signaling may exist on a VT1.5 basis in an OC-3 interface as DSN CCS evolves. Therefore, both DSN CCS and out-slot signaling are required.

### **A5.4.6 Reliability**

**[Required]** The SONET digital trunk interface shall meet the requirements contained in GR-874-CORE, “*An Introduction to the Reliability and Quality Generic Requirements (RQGR)*”, Issue 3, April 1997 and the requirements for switching systems specified in TR-NWT-000284, “*Reliability and Quality Switching Systems Generic Requirements (RQSSGR)*”, Issue 2, October 1990. Additionally, the SONET digital trunk interface shall conform to the reliability objectives

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for switching systems, including integrated digital terminations, as specified in GR-512-CORE, “*LSSGR: Reliability, Section 12*”, Issue 2, January 1998.

### **A.5.4.7 Security**

**[Required]** The SONET digital trunk interface shall not affect the switch meeting the requirements contained in Telcordia Technologies GR-815-CORE, “Generic Requirements for Network Element/Network System (NE/NS) Security”, Issue 2, March 2002, and conform to the requirements outlined in DODI 5200.40, 30 December 1997, “Defense Information Technology Security Certification and Accreditation Process (DITSCAP) and the DSN Security Technical Implementation Guide as applicable.