

Earth Science Mission Operations Project

423-35-02

Interface Control Document (ICD) between the EOS Mission Support network (EMSn) and Non-EOSDIS Core Systems (ECS) Element

**Tropical Rainfall Measuring Mission (TRMM) Science Data and
Information System (TSDIS)**

Revision A

December 2005

Expires: December 2010

RETIRED – September 2011

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National Aeronautics and
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Interface Control Document (ICD) between the EMSn and Non-EOSDIS Core Systems (ECS) Element

December 2005

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Preface

This ICD defines the interface between the EMSn and the non-ECS Element (TSDIS). This new document replaces the following existing document: *EBnet - TSDIS ICD (540-047)*. This document is under the configuration control of the Earth Science Mission Operations (ESMO). The ESMO Project is responsible for processing changes to it.

Proposed changes to this document will be submitted to the ESMO Configuration Control Board (CCB) and the Interface Control Working Group (ICWG) along with supportive material justifying the changes. Changes to this document shall be made by Document Change Notice (DCN) or by complete revision.

Questions concerning this document and proposed changes shall be addressed to:

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Abstract

This ICD defines the interfaces between the non-ECS element (TSDIS) and the EMSn.

Keywords: EMSn, ICD, Interface Control Document, TSDIS

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ISSUE	RELEASE DATE	PAGES AFFECTED	DESCRIPTION
Original	01/25/2005	All	CCR 423-35-02-001-R2
Revision A	12/14/2005	All	CCR 428-35-02-002
Retired	09/19/2011	All	CCR 428-0043

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Appendix A. Sensitive, Unclassified Information

Abbreviations and Acronyms

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Section 1. Introduction

1.1 Purpose

The purpose of this document is to provide a detailed definition of the interface(s) between EMSn and non-ECS element (TSDIS).

1.2 Scope

This document defines and specifies the data transport interfaces e.g., protocols, standards applied, physical connections, and locations connected) between EMSn-provided equipment, software, and communications paths, and other entities that directly interface with the network. Only interfaces between EMSn users and other systems as provided by the NASA Integrated Service Network (NISN) are included in the scope of this document.

1.3 Time Frame

This ICD will be in effect from the date of the last approval signature.

1.4 Standards Precedence

The EMSn will be based on Government, commercial, and international standards. In case of conflict, the following precedence (in descending order) applies:

- This EMSn ICD
- Government standards
- Commercial and/or international standards.

1.5 Document Organization

Section 2 contains the list of parent, reference, and applicable standards documents related to this ICD.

Section 3 details a systems overview of the EMSn, describes the EMSn system architecture, and identifies the EMSn objectives and services.

Section 4 provides a system overview of the TSDIS and describes EMSn-TSDIS interface characteristics. It also describes organization responsibilities and maintenance demarcations.

Appendix A lists sensitive, unclassified information associated with the EMSn-non-ECS elements interface (e.g., detailed architecture diagrams, equipment make and models, and applicable security information).

A list of abbreviations and acronyms is provided at the end of the document.

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Section 2. Related Documentation

2.1 Parent Documents

- [1] *Earth Science Data and Information System (ESDIS) Project Level 2 Requirements Volume 6: EOS Mission Support network (EMSn)*, Goddard Space Flight Center (GSFC) 505-10-01-6, Revision C, August 2001 [This document has been retired.]
- [2] *Earth Observing System (EOS) Ground System High-Level Architecture*, Goddard Space Flight Center (GSFC), 423-10-61, October 2001

2.2 Reference Documents

- [3] *Earth Science Data Information System (ESDIS) Project Level 2 Requirements, Volume 2: EOS Data and Operations System (EDOS)*, 423-10-01-2, Revision C, September 2001 [This document has been retired.]
- [4] *NASA Communications (Nascom) Access Protection Policy and Guidelines*, 541-107, Revision 3, GSFC, November 1995
- [5] *Internet Protocol Operational Network (IONET) Access Protection Policy and Requirements Document, Revision 3, June 2004.*
- [6] *Interface Requirements Document (IRD) Between the Earth Observing System Data and Information System (EOSDIS) and the Tropical Rainfall Measuring Mission (TRMM) Ground System*, 423-41-14, Revision A, April 1997
- [7] *Interface Control Document (ICD) Between the GSFC DAAC TRMM Support System (TSS) and the Tropical Rainfall Measuring Mission (TRMM) Science Data and Information System (TSDIS)*, 423-41-35, Revision A, July 1997
- [8] *NASA Procedural Requirements, Security of Information Technology, NPR 2810.1*, August 1999

2.3 Applicable Standards Documents

- [9] *Internet Protocol (IP): DARPA Internet Program Protocol Specification, Request for Comment (RFC) 791*, September 1981

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Section 3. EMSn System Overview

3.1 EMSn Description

The EMSn provides wide-area communications circuits and facilities between and among various EOS Ground System (EGS) elements to support mission operations and to transport mission data between EOSDIS elements. The relationship of the EMSn to other elements supporting EOS is presented in the *EOS Ground System High-Level Architecture* document [2]. The EOS Ground System Architecture diagram is located at the following URL: <http://esdis-it.gsfc.nasa.gov/add/images/EOS-Ground-Arch-Pict.html>.

The EMSn is responsible for transporting spacecraft command and telemetry data on a continuous basis, 24 hours a day, 7 days a week. The EMSn capability to transport these diverse types of data is implemented as a "real-time" network.

The real-time network transports mission-critical data related to the health and safety of on-orbit space systems and raw science telemetry as well as prelaunch testing and launch support. This highly redundant network provides services for mission-critical data:

- Operational availability of 0.9995
- Mean Time to Restore Service (MTTRS) of 1 minute to 2 hours, depending on data flow requirements
- 24x7 coverage
- 0.001 agreed packet loss ratio.

Visit the ESDIS Project website (<http://ensight.eos.nasa.gov/>) for additional information about EOSDIS Networks performance statistics.

3.2 EMSn Objectives

The objectives of the EMSn are to:

- a. Implement an operational, integrated, transparent communications system that serves the data communications needs of projects supported by the National Aeronautics and Space Administration (NASA) GSFC and users within EOSDIS.
- b. Expand using industry standard system solutions while maintaining compatibility with the existing network and user interfaces.
- c. Minimize costs for implementation, operation, and maintenance of the network.
- d. Minimize life-cycle costs.
- e. Maintain high availability by designing with redundancy and without single points of failure in the network backbone where required.

- f. Utilize state-of-the-art technology, utilizing equipment with the best price performance available commercially.
- g. Allow for growth, adaptability to changing requirements, infusion of new technology, and upgraded interfaces throughout the life cycle.

3.3 EMSn Services

There are several options for accessing the Internet Protocol (IP)-based EMSn transport service:

- Local Area Network (LAN)
 - Fast Ethernet (FE)
 - Gigabit Ethernet (GE)
- Wide Area Network (WAN) carrier service.

Figure 3-1 shows an example of each of these types of interface/demarcation points to EMSn users.

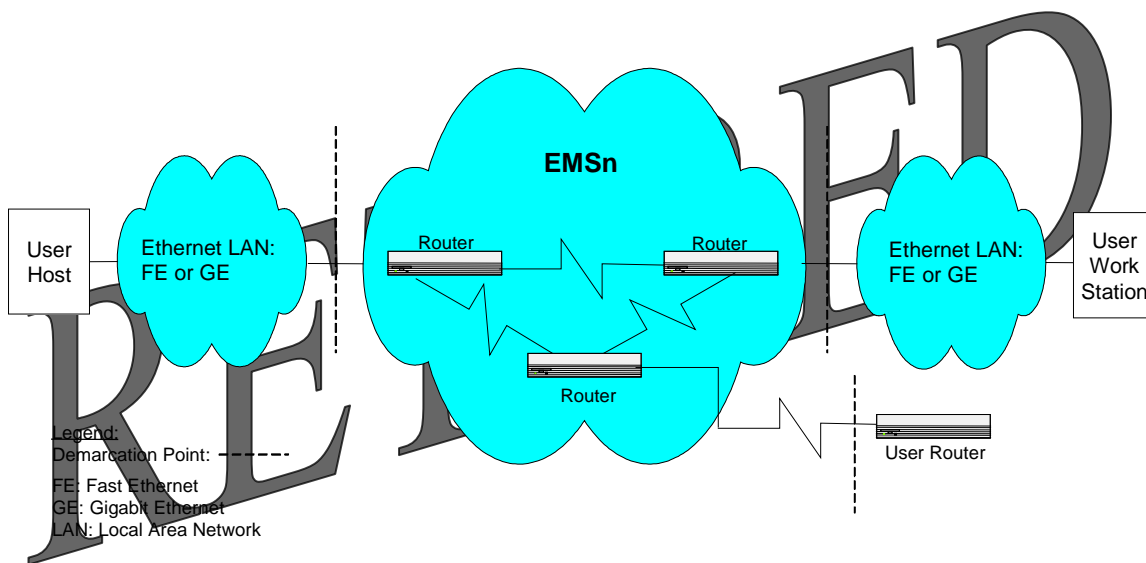


Figure 3-1. EMSn Demarcations

3.4 EMSn Security (Closed vs. Open)

The EMSn consists of an ‘open’ side and a ‘closed’ side. The open side allows appropriate data (generally, science data) to be transmitted via the Internet to various science users, with 0.995 availability and 4 hour restoral time 24 hours a day, 7 days a week. The closed side is protected by firewalls and transports mission data to various EOSDIS subsystems and ground stations via a secure network. Its performance levels are 0.9995 to 0.9998 availability and from 2 hours to less than 1-minute restoral time depending on the service level 24 hours a day, 7 days a week. Port blocking and blocking of IP addresses of systems identified as engaging in hostile activity is done

at the “door” routers, which serve as the demarcation point between the EMSn-Open and external networks. The port and host blocking is done on a network-wide basis, not for individual subnets. Service- or port-level filters for specific portions of the network are not provided on routers within the network. Such services will be provided on IPNOC-managed firewalls for EMSn-Closed support and IPNOC-managed or user-managed firewalls on EMSn-Open. Such services will be provided by NISN-operated firewalls for EMSn-Closed support or user-provided/operated firewalls on EMSn-Open. A diagram depicting the open and closed side connections is presented in Figure A-1 in Appendix A – Sensitive, Unclassified Information.

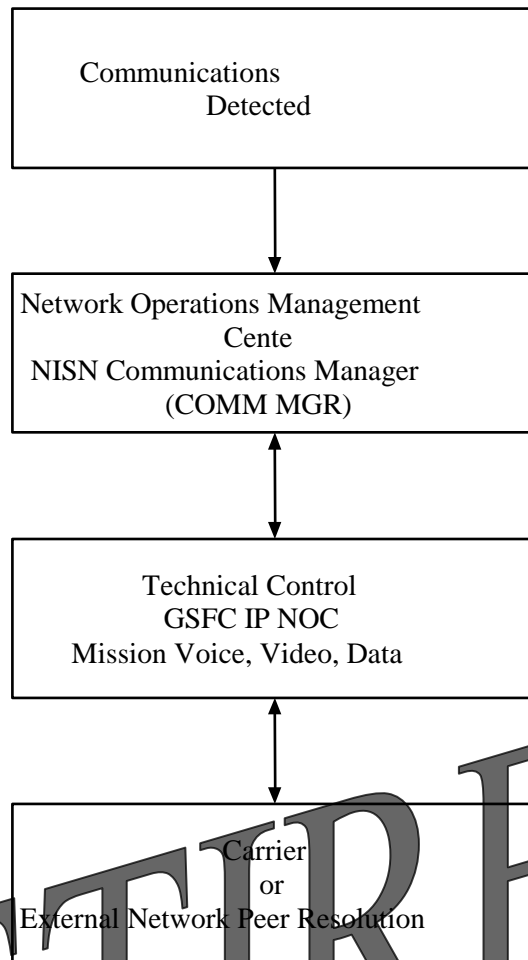
3.5 Overview of EMSn Interfaces

The EMSn will support transparent communication at the transport, session, presentation, and application layers. EMSn will utilize standard IP addressing conventions. The network administrators will provide a block of addresses, subnet mask, and gateway address.

3.6 EMSn Operational Support

Sustaining engineering, preventative and remedial maintenance, and network monitoring services are provided for EMSn WAN and LAN equipment to provide continuous service and keep pace with technology and standards. Often problems are detected and resolved before users are affected. However, when users detect a network problem, they are urged to immediately report it to the GSFC Communication Manager (COMM MGR). Figure 3-2 depicts the network problem resolution process for the COMM MGR. Refer to the *IONET Access Protection Policy and Requirements Document* [5] for information regarding user connections, security guidelines, and maintenance information.

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Figure 3-2. EOS Networks Problem Resolution

Section 4. EMSn – TSDIS Interface

4.1 TSDIS System Overview

The TSDIS is the data processing system that provides support for the Visible and Infrared Scanner (VIRS), TRMM Microwave Imager (TMI), and Precipitation Radar (PR) instruments flown on the TRMM observatory and corresponding Ground Validation (GV) data. TSDIS interfaces with four main entities: the SDPF, the TRMM MOC, the JAXA EOC, and the TRMM Support System (TSS). The SDPF provides satellite products to TSDIS. The TRMM MOC controls the satellite from the electronically secure closed segment of EMSn. The JAXA receives the standard data products from TSDIS. Finally, the TSS, an EOSDIS element, performs several functions:

- Archives TRMM science data products
- Distributes TRMM products to TSDIS for reprocessing
- Distributes ancillary data to TSDIS for processing and reprocessing
- Distributes TRMM products to TSDIS Science Users (TSUs)
- Provides TRMM data to the EOSDIS user community.

The TRMM Real-time system (TRMM RT) also uses TRMM data to provide near real-time data to users. The TRMM RT is primarily a scientific data service that is used by a variety of research organizations. The data it provides is largely not archived by GSFC and is not publicly available. The TRMM RT is housed in the TSDIS facility space, uses TSDIS network resources, and interfaces primarily with the SDPF. (See Figure 4-1.)

The TSDIS architecture is depicted in Figure A-2 in Appendix A – Sensitive, Unclassified Information.

4.2 Data Flow Requirements

The purpose of the interface between the TSDIS and EMSn is to support connectivity between the TSDIS and the various internal and external systems e.g., interfaces to TRMM MOC, SDPF, and TSS as well as connectivity to TSDIS workstations). All TRMM data flows supported by the EMSn are solely science traffic and are documented in the IRD between EOSDIS and TRMM Ground System [6].

4.3 Interface Characteristics

4.3.1 Data/Information Flows

The TSDIS major data flows are both to and from EMSn and EOS Science Support network (ESSn), with many flows destined for the TSS located at GSFC. The TRMM project will receive

Level 0 data from the SDPF, process that data, and make it available to TRMM Science Users (TSUs) through the Remote Science Terminal (RST) and via the TSS. In addition, these standard data products are transferred from the TSDIS to the TSS for archive and distribution by the TSS, and for later retrieval by the TSDIS for reprocessing. The TSDIS also has the capability to function as a proxy to request data from TSS for the TSUs. The TSS provides the requested data directly to the TSUs. The TRMM MOC sends archived data to the TSDIS.

The TSDIS transfers no real-time data to external locations. The TRMM RT system provides near real-time data to its customers. Its purpose is to provide weather data to RT users across the world. A high-level information flow diagram is located in Figure 4-1.

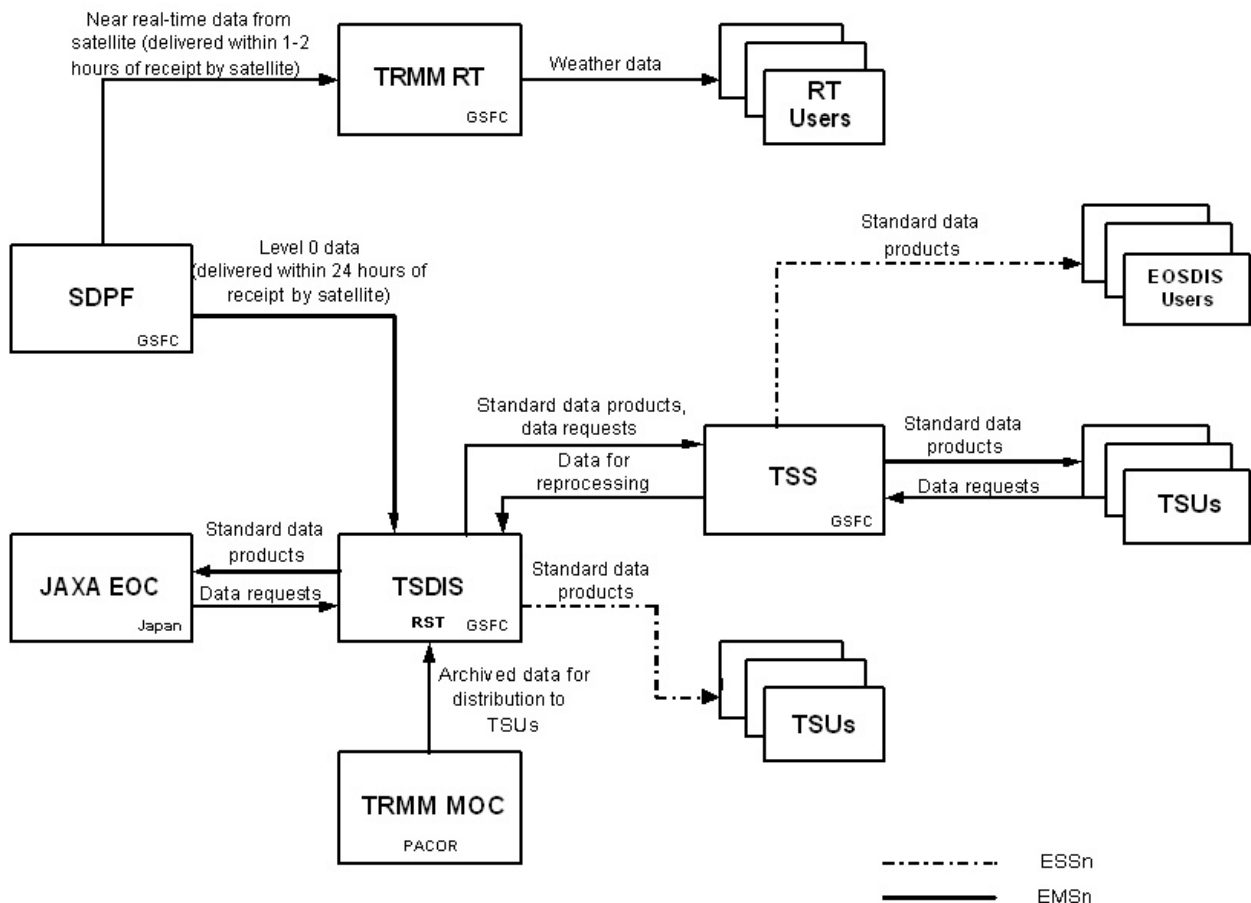


Figure 4-1. High-Level TSDIS Data Flows

4.3.2 EMSn Network Access and Connectivity

The EMSn will be internetworked by routers configured to support only TCP/IP and will provide isolation for separate networks. Figure A-2 in Appendix A – Sensitive, Unclassified Information illustrates the interface between the TSDIS and EMSn.

The EMSn will utilize standard IP addressing conventions. The EMSn will provide Class C subnet addresses to each connected user. The IPNOC network administrator will maintain the IP addresses for these routes.

Security requirements that govern network access for EMSn and other EOSDIS can be found in NASA Procedural Requirements, Security of Information Technology [8].

4.3.3 Network Protocols

The following sections detail the standards that will be supported by the EMSn. The EMSn supports network communication up to the network layer only. It will support transparent communications for all other layers.

The EMSn will provide network management using SNMP, including monitoring and control, for all EMSn-provided equipment (routers, concentrators, etc.).

4.5.4 Organization Responsibilities and Demarcations

The EMSn, Information Services and Advanced Technologies (IS&AT), and NISN support the TSDIS interface. The EMSn router is supported on a 24-hour, 7-day per-week basis. The TSDIS router is configured as a dual attached station (DAS). The EMSn will interface to the TSDIS router located at GSFC.

The demarcation point between EMSn maintenance and TSDIS maintenance is the connection at the TSDIS Router. Cabling will be provided and maintained by EMSn personnel. TSDIS personnel will provide 24-hour access to EMSn maintenance personnel for troubleshooting purposes. TSDIS operators will contact the COMMGR should there be a problem with connectivity to the EMSn router.

Please see *Appendix A – Sensitive, Unclassified Information*, for additional EMSn and TSDIS connectivity and configuration details.

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Appendix A. Sensitive, Unclassified Information

NOTE

The following information is considered sensitive, unclassified data pertaining to the interface between EMSn and non-ECS elements. Such data includes physical locations of equipment and detailed architecture diagrams.

A.1 Detailed Interface Diagrams

A.1.1 EMSn Architecture

The EMSn open-side and closed-side connections are shown in Figure A-1.

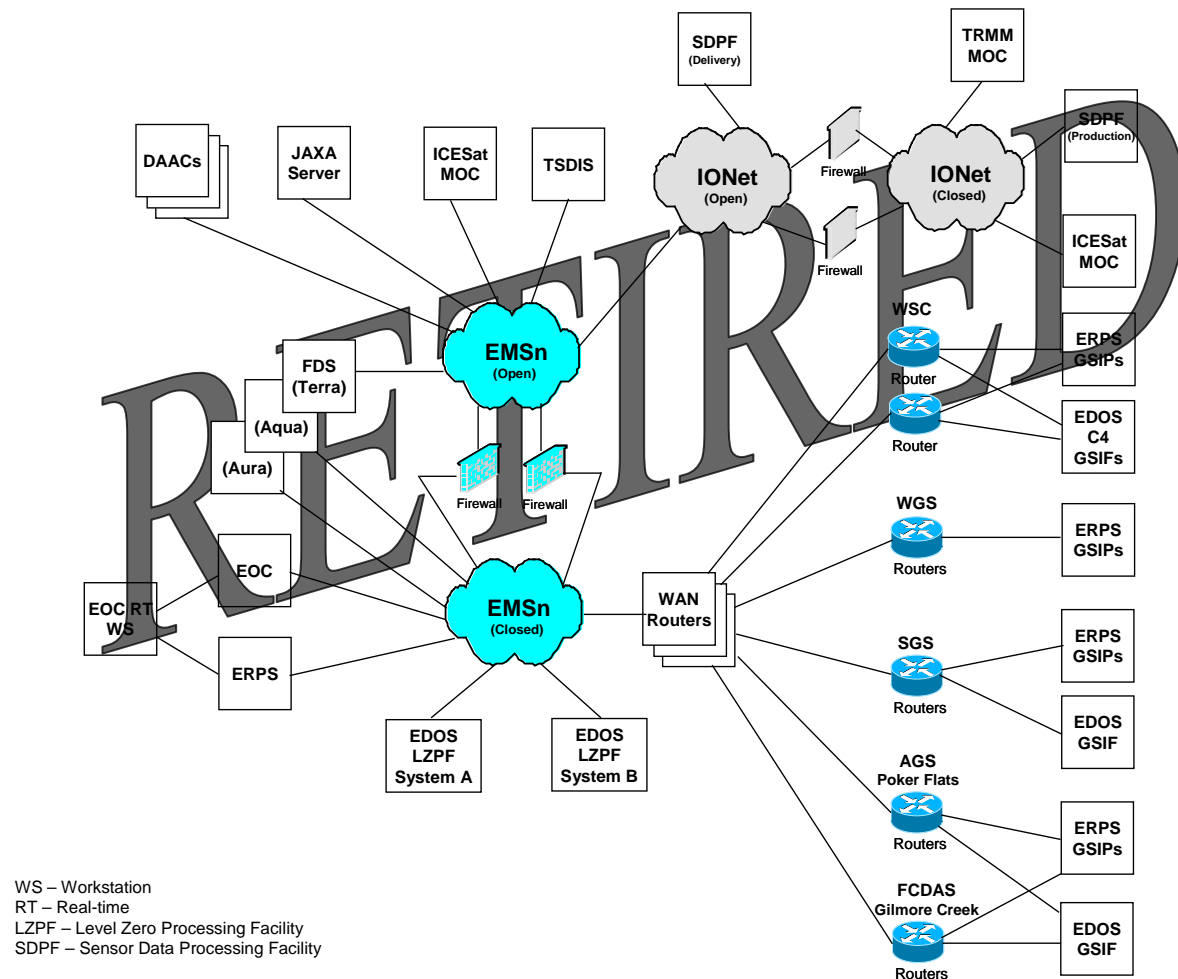


Figure A-1. EMSn Open and Closed Connectivity

EOS Sensitive – See Cover Page for Restrictions

A.1.2 TSDIS Diagram

The diagram in Figure A-2 illustrates the interface between the TSDIS and EMSn. A description of the interface and data flows is found in Section 4.3.2.

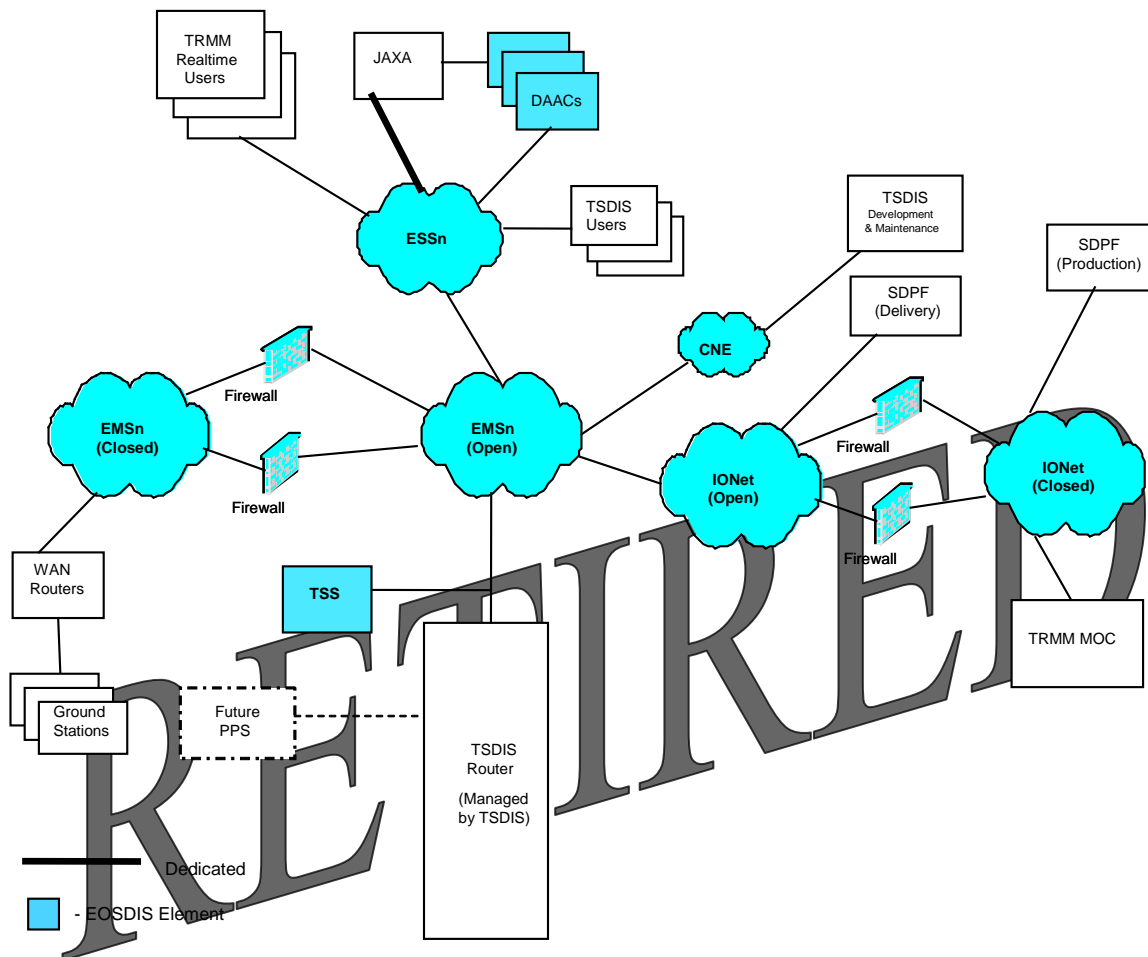


Figure A-2. TSDIS Architecture

A.2 Miscellaneous

The current phone number for the COMMGR is 301-286-6141.

Abbreviations and Acronyms

BRI	Basic Rate Interface
CCB	Configuration Control Board
CCITT	International Telegraph and Telephone Consultative Committee
COMMGR	Communications Manager
DAAC	Distributed Active Archive Center
DAS	Dual Attached Station
DCN	Document Change Notice
EBnet	EOSDIS Backbone Network
ECS	EOSDIS Core System
EDOS	EOS Data and Operations System
EGS	EOS Ground System
EMS _n	EOS Mission Support Network
EOC	EOS Operations Center
EOS	Earth Observing System
EOSDIS	Earth Observing System Data and Information System
ERPS	EOS Real-time Processing System
ESDIS	Earth Science Data Information System
ESS _n	EOS Science Support network
FE	Fast Ethernet
GDAS	Global Data Assimilation System
GE	Gigabit Ethernet
GN	Ground Network
GSFC	Goddard Space Flight Center
GSMS	Ground System Management Subsystem
GV	Ground Validation
ICD	Interface Control Document
ICWG	Interface Control Working Group

IEEE	Institute of Electrical and Electronic Engineers
IONET	IP Operational Network
IP	Internet Protocol
IPNOC	IP Network Operations Center
IRD	Interface Requirements Document
IS&AT	Information Services and Advanced Technologies
L0	Level Zero
LAN	Local Area Network
LLC	Logical Link Control
LZPF	Level Zero Processing Facility
MAC	Media Access Control
Mbps	Megabits per second
MOC	Mission Operations Center
MTTRS	Mean Time To Restore Service
NASA	National Aeronautics and Space Administration
Nascom	NASA Communications
NISN	NASA Integrated Services Network
NSIDC	National Snow and Ice Data Center
OSPF	Open Shortest Path First
PGS	Product Generation Subsystem
PHY	Physical Layer Protocol
PIM	Protocol Independent Multicast
PMD	Physical Layer Medium Dependent
PPP	Point-to-Point Protocol
PR	Precipitation Radar
RARP	Reverse Address Resolution Protocol
RFC	Request for Comment
RIP	Routing Information Protocol
RST	Remote Science Terminal

R/T	Real-time
SDPF	Science Data Processing Facility
SDPS	Science Data Processing Segment
SISS	Software Implementation Support Subsystem
SMC	Systems Monitoring and Coordination Center
SMT	Station Management
SNMP	Simple Network Management Protocol
TMI	TRMM Microwave Imager
TRMM	Tropical Rainfall Measuring Mission
TSDIS	TRMM Science Data and Information System
TSS	TRMM Support System
TSU	TRMM Science User
VIRS	Visible and Infrared Scanner
WAN	Wide Area Network

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