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INTERFACE CONTROL DOCUMENT
FOR THE
RPG BASE DATA DISTRIBUTION SERVER (BDDS) INTERFACE

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1 SCOPE

1.1 Identification

This Interface Control Document (ICD) identifies the interface design for the Radar Product Generation (RPG) Base Data Distribution Server (BDDS) application interface.

1.2 System Overview

Base Data Distribution was implemented as a function of the RPG, in a cooperative effort between the WSR-88D Radar Operations Center (ROC, W/OPS42), The National Severe Storms Laboratory (NSSL), and the Advanced Design and Development Laboratory (ADDL, W/OSD5). Base Data Distribution provides WSR-88D Base Data Distribution Service to non-RPG components - Base Data Distribution Clients (BDDCs) - via a Local Area Network (LAN). This data are also transmitted over NWSNet for Archiving. The Base Data Distribution function is implemented at most NWS and DoD sites.

1.3 Document Overview

This document defines the external interfaces between the RPG Base Data Distribution Service component (Base Data Distribution Server - BDDS) and non-RPG BDDC components. This document identifies applicable standards and defines the protocol, syntax, and meaning of the binary data transmission frames. This ICD is not intended to serve as a tutorial document concerning the applicable standards. That is, the reader is assumed to be generally knowledgeable of the contents, terminology, etc., of the standards. This document maps the unique aspects of the new RPG communications interface into the appropriate standard. Where this communications component follows the established standard, no further details are provided. Distribution of this document is unrestricted.

This document is organized in 5 sections including one Appendix:

- Section 1 provides information regarding the identification, scope, purpose and objectives, and organization of this document.
- Section 2 contains information about documentation relevant to this ICD, including parent, applicable, and information documents.
- Section 3 provides an overview of the interface, with a brief description of the elements involved.
- Section 4 provides a detailed description of the data exchange framework within the International Standards Organization (ISO) Open System Interconnection (OSI) Reference Model, the data transfer method, and descriptions of the data formats; and a description of the application level exchange between the BDDS and a BDDC.
- Section 5 contains a list of abbreviations, acronyms, and selected definitions.

2 REFERENCED DOCUMENTS

This section lists the number, title, revision, and date of all documents referenced in this specification. This section shall also identify the source for all documents not available through normal Government stocking activities.

2.1 Government Documents

2.1.1 Specifications

Reference Number	Title
2810000F	WSR-88D System Specification
2830013	System/Subsystem Design Document
2620002F	RDA to RPG ICD

Source:
WSR-88D Radar Operations Center
1313 Halley Circle
Norman, OK 73069
URL: http://www.osf.noaa.gov

Reference Number	Title
Special Publication 500-217	The Industry/Government Open Systems Specification (IGOSS)

Source:
National Institute of Standards and Technology
U.S. Department of Commerce
Gaithersburg, MD 20899
URL: http://www.nist.doc.gov

2.1.2 Military Standards and Handbooks

Reference Number	Title
MIL-STD-1777	Internet Protocol (IP)
MIL-STD-1778	Transmission Control Protocol (TCP)

Source:
Documentation Automation and Production Service
Building 4/D
700 Robins Avenue
Philadelphia, PA 19111-5094

2.2 Non-Government Documents

2.2.1 Industry Standards

Reference Number	Title
ISO 8802-2: 1989 ANSI/IEEE 802.2-1989	Part 2: Logical link Control

ISO/IEC 8802-3: 1993 ANSI/IEEE 802.3-1993	Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications

Source: American National Standards Institute
11 West 42nd Street
13th Floor
New York, NY 10036
URL: http://www.ansi.org

Reference Number	**Title**
IEEE P802.3u/D5, March 1995	IEEE Draft Standard for Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications: Media Access Control (MAC) Parameters, Physical Layer, Medium Attachment Units, and Repeater for 100 Mb/s Operation (version 5.0). Draft Supplement to 1993 version of ANSI/IEEE Std 802.3, 100BASE-T

Source: IEEE Standards Office
445 Hoes Lane
Piscataway, NJ 08855-1331

2.2.2 Request For Comments (RFCs)

Reference Number	**Title**
RFC 768	User Datagram Protocol
RFC 791	Internet Protocol
RFC 792	Internet Control Message Protocol
RFC 793	Transmission Control Protocol
RFC 826	Address Resolution Protocol
RFC 894	IP over Ethernet
RFC 950	IP Subnet Extension
RFC 1122	Requirements for Internet Hosts Communications Layers
RFC 1123	Requirements for Internet Hosts - Application and Support
RFC 1332	Point to Point Protocol Control Protocol
RFC 1597/1918	Address Allocation for Private Internets
RFC 1752	Recommendation for the IP Next Generation Protocol

Source: Internet Architecture Board (IAB)
Internet Engineering Task Force (IETF)
URL: http://www.ietf.org/home.html

3 INTERFACE OVERVIEW

The BDDS application provides an interface between the operational RPG and non-RPG external systems desiring to receive NEXRAD radar messages from the operational system. The BDDS application receives NEXRAD radar messages from an operational RPG and distributes the messages to non-RPG external users (BDDCs) connected as hosts on a Local Area Network (LAN). The following sections define the communications interface between the BDDS and BDDCs.

3.1 Functional Description

BDDS support for non-RPG external users is the standard client-server model for network applications. The BDDS server application waits to be contacted by a BDDC client application. When a client connects, the client and server establish a reliable TCP/IP stream socket connection. The BDDS application contains a "concurrent server" which accepts TCP/IP point-to-point client connection requests to its base data socket address. For each accepted socket connection from a point-to-point client, the server invokes another process to service that client as long as the client connection remains. The client service establishes a transmit-only TCP/IP stream socket connection with the client. The client service writes NEXRAD radar messages to the client. Each message consists of an application header, message header and message data, as described in Section 4.

The TCP/IP socket interface provides a stream I/O model which contains no record boundaries to the read or write operations. The BDDS application outputs an applications message header for each radar data message which contains the total message length of the following message. This allows the receiving client to determine the message boundary for each radar message read from the stream.

3.1.1 Protocol Overview

The BDDS application's host machine's physical communications links are supported by internetworking services that are consistent with the Open Systems Interconnection (OSI) reference model, as defined in the International Organization for Standardization, Basic Reference Model of Systems Interconnection (ISO 7498). Connection-oriented services are provided using the TCP/IP protocol suite (Transmission Control Protocol/Internet Protocol) socket communications. The layers defined explicitly in this ICD are the physical, data link, network, and transport layers.

Specification of any higher layers is combined in an API/data format layer. These combined layers accommodate the purpose of this ICD by defining the format for RPG data and control messages.

3.2 Component Descriptions

3.2.1 Component 1

The BDDS application will run on a Unix or Linux compatible host computer with a performance equal to or greater than a SUN Ultra 5 CPU as described for drawing 2210009-202.

3.2.2 Component 2

The BDDS application's host machine will utilize routers, switches and other data communication devices sufficient to provide connectivity to the NWS Frame Relay network and connectivity to certified BDDC's.

4 INTERFACE DESIGN

4.1 Physical Layer

4.1.1 Applicable Standard

The physical layer will contain a LAN interface as specified in either the ANSI/IEEE 802.3 (10 Mbps) or 802.3u (100 Mbps) Standard with the following caveat: The 2 octet length field that is specified in paragraph 3.2.6 of the ANSI/IEEE 802.3 Standard will be used as a type field for the interface as specified in the DIX Ethernet standard, version 2.0. This variance is allowed by Note 7 to paragraph 3.2.6 of the ANSI/IEEE 802.3 Standard as long as the value of this field exceeds 0x05EE (hex), which is the maximum IEEE 802.3 frame size. All values that will be used in this interface for this field, as specified in the DIX Ethernet Version 2.0 standard are 0x0800 and larger.

4.1.2 Communications Medium, Transfer Rates, Mechanical Connection

4.1.2.1 10 MBps

The baseband medium for a 10 Mbps network will be twisted pair cable, as specified in the ANSI/IEEE 802.3 Standard, paragraphs 10.5 and 14.1.1.3 respectively. This baseband medium and its associated Medium Attachment Units (MAU) are referred to as type 10BASET in the ANSI/IEEE 802.3 Standard. The maximum segment length of 10BASET segments will be no longer than 100 meters.

4.1.2.2 100 MBps

The baseband medium for a 100 Mbps network will be Category 5 twisted pair cable, as specified in the draft ANSI/IEEE 802.3u Standard. This baseband medium and its associated Medium Attachment Units (MAU) is referred to as type 100BASET in the draft ANSI/IEEE 802.3u Standard. The maximum segment length of 100BASET segments will be no longer than 100 meters.

4.2 Data Link Layer

4.2.1 Applicable Standard

The data link layer, which is composed of the Media Access Control (MAC) and Logical Link Control (LLC) sublayers for this interface, will be implemented as specified in the ANSI/IEEE 802.3 standard for the MAC sublayer and as specified in ANSI/IEEE 802.2 for the LLC sublayer.

4.2.2 Media Access Control Procedure

The media access control (MAC) sublayer mechanism for this interface will be Carrier Sense Multiple Access with Collision Detection (CSMA/CD) as specified in sections 3.0 and 4.0 of the ANSI/IEEE 802.3 Standard. The "improved" IEEE 802.3 MAC mechanism, that listens for the carrier to return during the first part of inter-packet gap, as described in the ANSI/IEEE 802.8 Standard, will be implemented in the MAC sublayer for this interface. (The ANSI/IEEE 802.3 Standard specifies the physical layer as well as the MAC sublayer for this interface.)

4.2.3 Logical Link Control

The Logical Link Control (LLC) sublayer protocol for this interface will be implemented as specified in the ANSI/IEEE 802.2 standard.

4.3 Network Layer

4.3.1 Applicable Standard

The network layer for this interface will support the Internet Protocol (IP) as specified in RFC 791 and MIL-STD 1777 and as clarified in RFCs 950, 919, 922, and 1122. The Internet Control Message Protocol (ICMP) [RFC 792], and Address Resolution Protocol (ARP) [RFC 826] will also be implemented for this interface. Subnet and host addresses for this interface will be assigned as appropriate. Data from the BDDS may be transported via NWSNet and used for Archiving at NCDC.

4.3.2 Internet Protocol (IP) Description

The Internet Protocol (IP), supports network layer data exchanges between the BDDS and individual BDDC's. The network layer provides the transparent transfer of data between transport entities. The IP addresses for the network nodes and data hosts are determined at installation time.

4.4 Transport Layer

4.4.1 Applicable Standard

The transport layer for this interface will support the Transmission Control Protocol (TCP) as specified in RFC 793 and MIL-STD 1778 and as clarified in RFC 1122.

4.4.2 Transport Header Description

Connection-oriented transport service is implemented using TCP. TCP is a connection-oriented, end-to-end reliable protocol designed to fit into a layered hierarchy of protocols which support multi-network applications. It provides for guaranteed delivery of data between pairs of processors in host computers attached to networks within and outside the RPG system.

4.5 Session Layer

The OSI Session, Presentation, and Application layers are defined by an Applications Programming Interface (API), and the format of the messages which are transferred.

4.6 Presentation Layer

The OSI Session, Presentation, and Application layers are defined by an Applications Programming Interface (API), and the format of the messages which are transferred. See Section 4.

4.7 Application Layer

4.7.1 Description

The OSI Session, Presentation, and Application layers are defined by an Applications Programming Interface (API), and the format of the messages which are transferred.

4.7.2 Application Programming Interface (API) for Legacy BDDS connections.

The interface between TCP and an application process consists of a set of calls much like the calls an operating system provides to an application process for manipulating files. There are calls to open and close connections and to send and receive data on established connections. The Base Data Distribution Server (BDDS) application implements the sockets API to the TCP/IP protocols.

Data exchange between the BDDS and Base Data Distribution Clients (BDDCs) is initiated by the client establishing a network connection with the BDDS. The connection-oriented protocol established with the socket interface provides reliable transfer of RDA/RPG messages from the BDDS to each BDDC, as data are available, until the connection is terminated. The following sections describe client application requirements.

4.7.3 Operating Procedures

4.7.3.1 Description

Once connected the BDDC receives the messages which are exchanged between the RDA and RPG. The message type which the BDDC receives is configurable in the BDDS application.
NOTE: Need to ask ISL about additional Operating Procedures.

Define the applicable standard governing session procedures for the interface. Describe the priorities, timing, frequencies, volume, sequencing, and other operating constraints. Describe the sources/send entities for each message and the recipient/receiving entities for each message type.

4.7.3.2 Connection

The BDDC must specify the communication protocol family, connection type, and protocol for the socket connection to the BDDS as follows:

Family = Internet Protocols (IP)
Type = Stream Socket
Protocol = TCP

The BDDC must connect the stream socket to the BDDS, specifying the BDDS host address and BDDS port number for NEXRAD radar data as follows:

Address = BDDS Internet address
Port Number = 62878

4.7.3.3 Data Exchange

Following a successful network connection to the BDDS, the BDDC application reads RDA/RPG messages on the connection. Each message read consists of Applications Header, followed by NEXRAD Message Header, and ending with NEXRAD Message Data, formatted as detailed in section 4.7.4 below:

Message = Applications Header + NEXRAD Message Header + NEXRAD Message Data.
The Applications Header consists of the integer byte length of the remainder of the message. The integer byte length, which is transmitted in network order, does not include the Applications Header length.

The BDDS Client-Server connection is a server transmit-only and client receive-only connection at the application level. The client application should NOT attempt to write to the BDDS. Any attempt to write will be ignored by the BDDS and will be left incomplete by the network protocol. Moreover, since the Base Data Distribution LAN is shared by other BDDC's, excessive traffic could affect their reception of Base Data.

4.7.3.4 Disconnection

Each BDDC application may disconnect from the BDDS at any time by closing the TCP/IP socket connection. The BDDS may disconnect from a BDDC at any time by closing the TCP/IP socket connection. Disconnection may also occur at any time due to any one of the following conditions:

a) The BDDC closes the connection.
b) The BDDC terminates.
c) The BDDS closes the connection.
d) The BDDS terminates.
e) The connection is broken due to BDDS or BDDC host failure or networking problem.
f) The BDDS terminates the client connection due to an expired indication from its input buffer which indicates the client is not accepting NEXRAD radar data in a timely manner.

Following any disconnection, the client must initiate a new connection request.

4.7.4 Message Types

The message types available to the BDDC via the legacy interface are listed in Table I below. The message formats are defined in ICD 2620002. There are no messages defined for transfer from the BDDC to the BDDS.

Table I Data Message Types

TYPE	DESCRIPTION	SOURCE	RECIPIENT	FORMAT
1	Digital Radar Data	RDA	RPG	Table III *
2	RDA Status Data	RDA	RPG	Table IV *
31	Digital Radar Data Generic Format	RDA	RPG	Table XVII *

* See the RDA/RPG ICD (2620002) for message format

4.7.5 Message Format

The message format is given in Table II below. The composition of message header, and digital radar data are as specified in the ICD 2620002. Refer ICD 2620002 for size, units of measurement, range or enumeration of possible values, and accuracy with regard to RDA/RPG message headers and RDA/RPG message types exchanged.

TABLE II Message Format

NAME	DESCRIPTION	FORMAT	UNITS	RANGE	BYTE LOCATION
Message Size	Size of the BDDS message starting with the RDA/RPG Message Header.	Integer*4	byte	16 to 131086	0 - 3
Message Header	RDA/RPG Message Header	See ICD 2620002 Table II	N/A	N/A	4 - 19
Message Data	RDA/RPG Message Data	See ICD 2620002 Section "Message Descriptions"	N/A	N/A	20 ≤ 131090

APPENDIX A ACRONYMS AND GLOSSARY

ANSI	American National Standards Institute
ARP	Address Resolution Protocol
BDDC	Base Data Distribution Client
BDDS	Base Data Distribution Server
bps	Bits per Second
Byte	Eight contiguous bits
CCITT	Consultative Committee for International Telegraph and Telephone
CSMA/CD	Carrier Sense Multiple Access with Collision Detection
DCE	Data Circuit Terminating Equipment/Data Communications equipment
DTE	Data Terminal Equipment
Frame	A segment of a bit stream bounded by a uniquely recognizable bit sequence and containing a specified number of bits or bytes of data.
IAB	Internet Architecture Board
ICD	Interface Control Document
ICMP	Internet Control Message Protocol
IDD	Interface Design Document
IEEE	Institute of Electrical and Electronics Engineers
Internet	Any network conforming to the standards of the IAB.
IP	Internet Protocol
ISO	International Standards Organization
LAN	Local Area Network
LLC	Logical Link Control
LSB	Least Significant Bit/Least Significant Bytes
MAC	Media Access Control
Mbps	Million Bits per Second
Message	The complete set of information transported from the source to the destination. A message may be radar data or NEXRAD control information.
MSB	Most Significant Bit/Most Significant Bytes
Network Order	Internet standard byte ordering for multiple byte integers.
NEXRAD	Next Generation Weather Radar
RPG	Open Radar Product Generation
OSI	Open Systems Interconnection
Packet	A communication block configured to permit independent handling in a packet switching network. In most cases this means configured to be compatible with the CCITT Recommendation X.25.
PUP	Principal User Processing Functional Area
RDA	Radar Data Acquisition Functional Area
RFC	Request for Change (IAB)
RPG	Radar Product Generation Functional Area
TCP/IP	Transmission Control Protocol/ Internet Protocol