12B.3 PROGRESS IN IMPLEMENTING NEAR REAL TIME COLLECTION, DISTRIBUTION, AND ARCHIVE OF WSR-88D LEVEL II DATA

Tim Crum *
NEXRAD Radar Operations Center, Norman, Oklahoma

Kevin Kelleher
NOAA/OAR National Severe Storms Laboratory, Norman, Oklahoma

Phil Cragg, Joe Barna, Fred Toepfer, Warren Blanchard, and Tom Sandman
NOAA/National Weather Service, Silver Spring, Maryland

Kelvin Droegemeier
Center for Analysis and Prediction of Storms, University of Oklahoma, Norman, Oklahoma

Guy Almes
Advanced Network and Services, Inc., Armonk, NY

Linda Miller
UCAR/Unidata Program Center, Boulder, Colorado

1. INTRODUCTION

The National Weather Service (NWS) announced plans to electronically collect, distribute, and archive Weather Surveillance Radar - 1988 Doppler (WSR-88D) Level II data in near real time (AMS, 2003) during the February 2003 AMS Annual Meeting. The NWS plans to implement this new capability to replace the in-place Level II tape recorders and to meet new NWS operational requirements for access to these data in near real time. The benefits of this approach include lower WSR-88D Level II archive operations and maintenance costs, increased reliability and timeliness of Level II data receipt at the National Climatic Data Center (NCDC), and near real time availability of these data to meet NWS operational requirements primarily for the National Centers for Environmental Prediction (NCEP). An additional benefit of this approach is to make these data available to external users (users outside the NEXRAD Program). An initial update of these plans appeared earlier (Crum et al, 2003).

Members of the NWS staff have been working to develop the plans for implementing this ambitious project. When the project is fully implemented by the end of 2004, 121 NWS and 11 Department of Defense (DOD) CONUS operational weather radars will be transmitting Level II data to the NCDC, NCEP, and other users in near real time. This paper describes progress the NWS has made in implementing this project in 2003.

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* Corresponding author address: Dr. Tim Crum, Radar Operations Center, 1200 Westheimer Dr., Norman, OK 73069; e-mail: Tim.D.Crum@noaa.gov.

The views expressed are those of the authors and do not necessarily represent those of the National Weather Service.

2. OVERVIEW OF NWS LEVEL II DATA COLLECTION AND DISTRIBUTION PLANS

The NWS plans to implement the NWS Level II Data Collection and Distribution Network in two basic phases:

(1) an Initial Operational Capability (IOC) scheduled to be completed by the end of 2003; and
(2) the Full Operational Capability (FOC) scheduled for completion by the end of 2004.

The NWS designed the IOC and FOC phases to ensure:

(1) the NWS delivery requirements for these data are met: one-minute latency (as measured from the time the data reaches the WSR-88D Base Data Distribution System (BDDS) to when the data reaches a central distribution point) and a 95% reliability of receipt of the data (measured when a radar is operational) at the central collection point at the University of Maryland;
(2) the initial capital investment and on-going operations and maintenance cost are as economical as possible for the services required; and
(3) the required information technology security safeguards are met.

A Web site (http://www.roc.noaa.gov/NWS_Level_2) has been created to facilitate distribution of project updates and information.

3. DETAILS OF NWS PROPOSED INITIAL OPERATIONAL CAPABILITY (IOC)

In implementing the IOC, the NWS plans to leverage the successful Collaborative Radar Acquisition Field Test (CRAFT) Project (Droegemier et al 2002) by supporting continued CRAFT operations; add data compression/data

manager PCs/workstations at the approximately 60 NWS sites that are not a part of CRAFT. The PC/workstation software will compress (BZIP2) and route (Unidata Local Data Manager (LDM)) the Level II data. The NWS will add 128 kbps of bandwidth per radar to the NWSNet frame relay between NWS weather forecast offices (WFOs) and their regional headquarters (located at Bohemia, NY; Fort Worth, TX, Kansas City, KS; and Salt Lake City, UT). Servers at the regional headquarters will send the data via DS3 connections to a designated Abilene Network/Internet2 gigapop (http://abilene.internet2.edu) to enter the data into the Abilene Network/Internet2 "cloud." Using LDM technology, the data will be routed to the CRAFT server at the University of Oklahoma for further redistribution to NCDC, NCEP, and other users.

At the conclusion of the IOC, data from all 121 NWS radar sites and 4 DoD sites (Altus AFB, Vance AFB, Columbus AFB, and Holloman AFB) will be collected and available for distribution. The DOD sites were selected based on NCEP requirements and because BDDSs are already connected to these sites. The BDDS serves as the Level II interface with external users and is not available at the FAA sites, but is available at select DoD sites.

4. DETAILS OF NWS PROPOSED FULL OPERATIONAL CAPABILITY (FOC)

In completing the implementation of this project, the NWS will add the remaining DoD sites where data will be collected and complete the collection and distribution architecture. The NWS will purchase and install BDDS hardware to connect 7 additional DoD WSR-88D systems to the network; move the data compression and LDM software running on the PCs/workstations in IOC onto the BDDS in RPG software release Build 5 (scheduled for release to the network beginning 31 March 2004); and install the remainder of the data distribution infrastructure - the Top Level Relay Node LDM server located at the University of Maryland (UM) in place of the University of Oklahoma CRAFT node. Drawings of possible network architectures are located at: http://www.roc.noaa.gov/NWS_Level_2/

Below is the list of 11 operational DOD WSR-88D sites (along with the NWS weather forecast office (WFO) that will host the BDDS) planned to be available at the FOC:

DOD WSR-88D Site	Host WFO
Altus AFB, OK	Norman, OK
Cannon AFB, NM	Albuquerque, NM
Columbus AFB, MS	Jackson, MS
Dover AFB, DE	Wakefield, VA
Dyess AFB, TX	Fort Worth, TX
Eglin AFB, FL	Mobile, AL
Fort Drum, NY	Burlington, VT
Holloman AFB, NM	El Paso, TX
Robbins AFB, GA	Atlanta, GA
Laughlin AFB, TX	New Braunfels, TX
Vance AFB, OK	Norman, OK

The proposed architecture is robust enough to provide alternative routings of the data. For example, the regional servers and DS3 connections to the Abilene Network/Internet 2 are able to accommodate more than one data feed. Thus, experience could determine if additional data streams should be directed from the NWS regional headquarters. This change could provide redundancy of the data if a central node becomes unavailable for example, or if another data feed is needed to accommodate future data distribution requirements.

5. ADDITIONAL CONSIDERATIONS

Until the NEXRAD agencies have implemented the FOC network, external agencies can request connection to an existing BDDS following the NEXRAD Program Management Committee Guidelines (http://www.roc.noaa.gov/BDCI/wbpolicy_PMC_App_0203.pdf). The guidelines are intended to minimize the impact of these connections on weather forecast office staff while still providing access to these data.

With the scheduled FY05 deployment of the WSR-88D Open Radar Data Acquisition (RDA), the radars could produce higher resolution data. If dual polarization is later implemented, even more data streams could be provided. The estimated bandwidth requirements needed for these additions to the RDA-to-RPG data stream are described in Crum et al, 2003. The NWS will evaluate the operational need for collecting, distributing, and archiving these additional data streams as they become available. It is possible, at least initially, that not all of these data streams will be added to the near real-time data collection, distribution, and archive plans.

The content of the Level II data stream will be changing. The data available during the IOC will not contain metadata. These metadata were available at the start of each volume coverage pattern on tapes recorded on site, but are not currently available at the RPG/BDDS. In Build 5 the BDDS will begin to provide metadata. Information on the content of the Level II data will be available at http://www.roc.noaa.gov/NWS_Level_2.

The NWS hosted a one-day public meeting on 18 June 2003 to discuss the proposed NWS Level II network. The results of this meeting will be discussed at the Radar Conference and be the subject of future manuscripts.

The NWS is working with Unidata to determine the optimal way to distribute these data to the university and research community. Details of how the data will be distributed to other users and the commercial sector are still being discussed.

6. SUMMARY

The NEXRAD Program is progressing toward an initial operating capability by the end of 2003 to electronically collect, distribute, and archive WSR-88D Level II data in near real time. The proof-of-concept project, CRAFT, has successfully demonstrated the capability to compress, collect and distribute WSR-88D base data to the NCDC and users in near real time via the Internet, Internet2, and private communications links. Based on a cost-benefit analysis, these data can be sent from the NWS and select

CONUS DoD WSR-88D systems to NCDC in near real time for archival at a lower cost than replacing the existing in-place 8mm recorders with a new generation of in-place recorders. When the full operational capability is achieved by the end of 2004, the NEXRAD agencies and the entire meteorological community will have access to the highest resolution digital data the WSR-88D produces. This will make possible new and exciting research and new applications based upon these data.

7. REFERENCES

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