NEW MEXICO
DEPARTMENT OF
INFORMATION TECHNOLOGY

New Mexico State Broadband Initiative
Methodology: October 1, 2011

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New Mexico State Broadband Initiative
Methodology: October 1, 2011

Table of Contents

New Mexico SBI Methodology / October 1, 2011 / www.nmbbmapping.org

New Mexico State Broadband Initiative
Methodology: October 1, 2011

Introduction

The State of New Mexico (hereafter, NM or State), through its agents Earth Data Analysis Center (EDAC) at The University of New Mexico and NM Department of Information Technology (DoIT), submitted the October 1, 2011 New Mexico Broadband (NMBB) Program data package, in compliance with the National Telecommunications and Information Administration (NTIA) State Broadband Initiative Program (SBI).

Data Submittal Description

The NMBB October 1, 2011 data submission included:
- Data Transmittal Memo (PDF). This document described NMBB data submittal components, state-restricted data fields, and contact information.
- Provider Data Request Template (XLS). The data-request spreadsheet contained an overview and upload instructions in addition to eight worksheets for different types of service, subscriber speed, and community anchor institutions.
- FCC-prepared Data Package Spreadsheet (XLS). The data-package spreadsheet consisted of three worksheets for overview and checklist, record count, and provider table.
- NTIA-compliant Geodatabase with FGDC-compliant Metadata (GDB). The NMBB geodatabase was created to NTIA standards and included metadata for the database layers.
- Check Submission Receipt (TXT). This document listed pass/fail for received data-submission layer and field entries.
- NM Methodology 20111001 (PDF). This Methodology document is included in the submitted package.
- Changes and Corrections 20111001 (PDF). The document corresponds to a readme document, especially for Internet Service Provider (ISP) information.

All files were zipped together and submitted as NM_SBDD_20111001 (ZIP).

SBDD Geodatabase Layer	Number of Records: October 1, 2011
BB_Service_Address	0*
BB_Service_Road_Segment	4158
BB_Service_CensusBlock	157454
BB_Service_CAInstitutions	2606
BB_Service_Wireless	77
BB_Service_Overview	115
BB_ConnectionPoint_LastMile	0*
BB_ConnectionPoint_MiddleMile	424

* Due to restrictions in the Non-disclosure Agreement (NDA) with New Mexico Internet Service Providers (ISPs), New Mexico cannot populate the Service Address and Last-Mile feature classes in the NMBB Geodatabase.

Provider Participation

The NMBB Program requested broadband data from seventy NM Internet Service Providers (ISPs) in July 2011. A total of forty-two different ISPs provided data to the NMBB Program, representing thirty-seven companies. Seven providers did not submit new data for the October 2011 submittal, and two companies (Cyber Mesa Computer Systems Incorporated and Higher-Speed Internet, LLC) were reluctant to further participate in the program. Six ISPs confirmed that they currently do not provide broadband services in New Mexico.

CenturyLink replaced Qwest Corporation as a Provider in New Mexico, and the NMBB Program negotiated and executed an NDA with CenturyLink before this October 2011 data submittal.

Internet Service Providers	Number: October 1, 2011
Contacted	70
Responded: Provided Data	42*
Responded: Will Provide Data	3
Responded: Will not Participate	2
Responded: Not Broadband Provider	6**
Did Not Respond	22

* 5 ISPs of 42 provided data as 2 distinct companies/subsidiaries; 1 ISP would not provide data but directed NMBB to data on their Web site.
** These ISPs are not broadband providers for New Mexico.

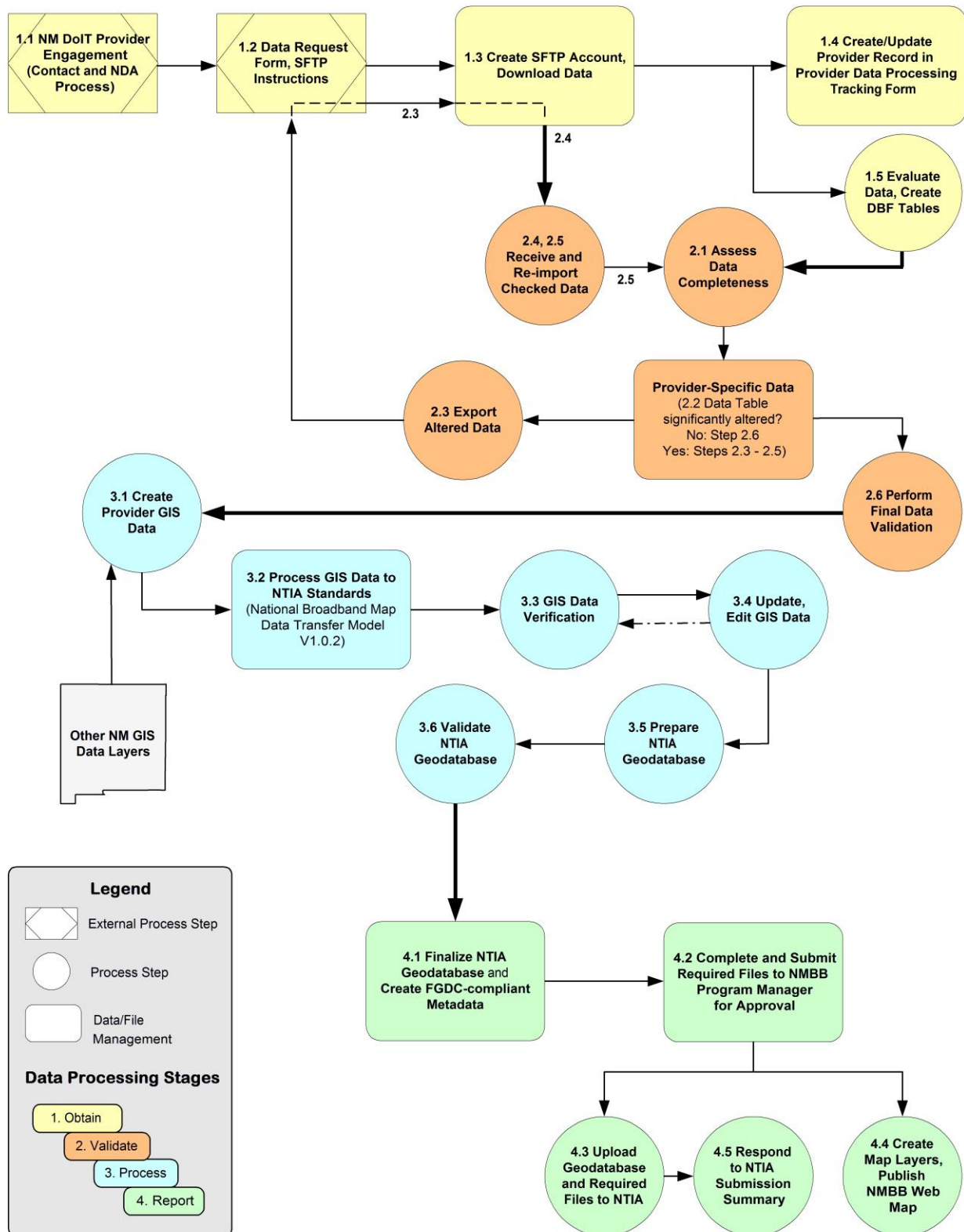| Participating New Mexico Internet Service Providers: NTIA Data Submittal, October 1, 2011	
360networks (USA) Inc.	PTCI (Panhandle Telephone Cooperative, Inc.)
Agavue Broadband LLC	PVT Networks
AT&T Mobility LLC	Sacred Wind Communications, Inc.
Baca Valley Telephone Company, Inc.	Sierra Communications (a subsidiary of Baca Valley Telephone)
Baja Broadband	Southwestern Wireless
Cable ONE	Sprint
CenturyLink (replaced Qwest Corporation)	Suddenlink Communications
Comcast	T-Mobile
Cricket Communications, Inc.	Time Warner Cable
Cyber Mesa Telecom	Tularosa Communications, Inc.
Dell Telephone Cooperative, Inc.	TW Telecom of New Mexico, LLC
DIECA Communications, Inc. (Covad Communications Company)	US Cable
ENMR Plateau Telecommunications	Valley TeleCom Group (Copper Valley Telephone, Inc.)
Frontier Navajo Communications (Navajo Communications Company, Inc.)	Valley TeleCom Group (Valley Telephone Cooperative, Inc.)
Higher-Speed Internet, LLC	Verizon Wireless
La Jicarita Rural Telephone Cooperative	Windstream Communications SouthWest
Leaco Rural Telephone Cooperative	WNM Communications
Level 3 Communications, LLC	Yucca Telecom (Roosevelt County Rural Telephone Cooperative, Inc.)
MATI Networks (Mescalero Apache Telecom, Inc.)	Yucca Telecom

	(Yucca Telecommunication Systems, Inc.)
Penasco Valley Telecommunications	Spacenet, Inc. (StarBand Communications, Inc.)
Plateau Telecommunications, Inc.	WildBlue Communications, Inc.

Workflow Processing Scheme

New Mexico acknowledges the importance of understanding data reliability and integrity as the Provider data are processed for NTIA submittal. The NMBB Data Workflow and Processing Scheme include four broad stages:

1. Obtain – Acquire raw Provider data.
2. Validate – Check for internal data consistency and for consistency with external data sources.
3. Process – Develop Geographic Information System (GIS) data and update NTIA Geodatabase.
4. Report – Submit the final Geodatabase to NTIA.

These stages and their relationships are depicted in the diagram below, and are discussed in the following sections. The October 1, 2011 Data Workflow and Processing Scheme did not change from the April 2011 scheme and so retained the V3.0 designation.

Figure 1 New Mexico Broadband Workflow and Processing Scheme

New Mexico Broadband Data Workflow and Processing Scheme V3.0 10.01.2011 EDAC

Data Collection

Provider Engagement

The NM Department of Information Technology established contact with each New Mexico Broadband Provider and negotiated a signed NDA with the State and with EDAC, if required. NM DoIT negotiated and executed a new NDA with CenturyLink, which replaced Qwest Corporation.

Data Request

EDAC sent an e-mail requesting broadband data to seventy NM Internet Service Providers in July 2011, and a reminder e-mail in August to those who had not responded. In addition to an NMBB Program overview and formal request for data, the message included a Web link for the NM Broadband Data Request Form (MS Excel Worksheet); this form included instructions for completing the eight data worksheets and for securely uploading Provider data to the EDAC Secure FTP site.

Data Receipt

EDAC created a Secure File Transfer Protocol (SFTP) site for broadband data upload, and created an account on the site for each NM Provider. Each Provider was assigned a unique username and password; this account information is stored in the NMBB SFTP Account Management form.

Provider data arrive in numerous formats, including NMBB or Provider spreadsheets, shapefiles, CAD files, and text files. These data are downloaded from the SFTP site to the EDAC network.

Provider and Data Tracking

EDAC creates or updates the specific Provider record in a Provider Data Processing Tracking Form. Throughout the data process, each Tracking Form step is recorded with analyst initials and date of task completion. Steps include:
- Record Provider name information and the assigned 2-digit Primary Key (PKey).
- Record the Holding Company Name, DBA Name, FRN (if available), and whether Community Anchor Institutions data are provided.
- Record type of files submitted; date of data submission and the initials of the receiving GIS analyst; and how data were submitted (e.g., FTP or physical medium).

Provider Database

EDAC evaluates the uploaded Provider data for consistency with the NTIA data model and creates database-format tables.

Data Validation

Data Assessment

EDAC assesses the submitted data for completeness according to the National Broadband Map Data Transfer Model V1.0.2:
- Identify fields (names, types);
- Fill in missing data, if possible; and
- Check field codes, and standardize the values where appropriate.

Data Export

If the data are incomplete, based upon the above assessment steps, EDAC performs the *If required* steps, below; otherwise, EDAC proceeds with data validation. Changes and assumptions are documented.

If required:

- Return data in standardized format to the Provider for completion.
- Receive modified data back from Provider.
- Re-import data.

Data Validation

EDAC performs the final data validation for each Provider's data set: all missing data filled in; all field codes checked and standardized where appropriate.

Data Processing

GIS Data

EDAC creates and verifies Provider-specific GIS data, using ArcGIS 10 software and third-party data sets:

- New Mexico Road Centerline (NM RCL) data files.
- NM Telephone Exchange Boundaries 911.
- U.S. Census TIGER/Line shapefiles.
- TomTom MultiNet Road shapefiles.
- NAVTEQ Road data files.
- ESRI Road shapefiles.
- ESRI Cable Boundaries data file.

Ancillary consistency checks include comparison with other data sources that are available through the New Mexico geospatial clearinghouse – Resource Geographic Information System (RGIS; http://rgis.unm.edu).

EDAC processes the GIS data according to the National Broadband Map Data Transfer Model V1.0.2.

Middle Mile Points

- ISPs provide the geographic coordinates for Middle Mile points. Those points are exported as shapefiles and a spatial join is performed against Census 2010 Blocks to obtain FULLFIPSID.
- Data sets are further processed by adding required fields based on the NTIA Data Model.

Census Blocks

- ISP data were requested for the Census 2010 Blocks, rather than the Census 2000 Blocks.
- If an ISP provides the Census Block IDs, then those tables are spatially joined with the Census 2010 Data and the blocks are extracted. Then, the Census Blocks (Area < 2 sq mi) are extracted.
- If the ISP provides address-specific data, those addresses are geocoded against the New Mexico Road Centerline (NM RCL) address locator. Unmatched addresses are processed against third-party data sets, such as the TomTom MultiNet and NAVTEQ Road data, which were purchased by the State as a part of the NMBB project, and ESRI Road data. All of those matched records are appended together to obtain a single address data set. The address points are aggregated spatially to the Census Blocks, and the Census Blocks (Area < 2 sq mi) are extracted.

- If an ISP provides shapefiles of Census Blocks, EDAC verifies those to make sure they are less than 2 sq. mi. in area.
- If an ISP provides their telephone exchange boundaries instead of addresses, then those boundaries are verified with the NM Telephone Exchange Boundaries 911 data set, and Census Blocks (Area < 2 sq mi) that lie within those boundaries are extracted. If an ISP provides the CO/RT locations, then a buffer of 1800 ft is drawn, and the Census Blocks (Area < 2 sq mi) that intersect with the buffer area are extracted.
- If an ISP provides service areas instead of addresses for Cable, then the service areas are verified with the ESRI Cable Boundaries data file. Census Blocks (Area < 2 sq mi) that lie within the boundaries are extracted.
- If an ISP does not provide data for this data-submittal round, Crosswalk tables from the U.S. Census Bureau are used to convert the previously-submitted Census 2000 Blocks to Census 2010 Blocks. Extracted Census 2010 data are overlaid on the original Census 2000 data to confirm that the ISP-provided area from the previous round is covered. In cases of differences, where the areas are not covered, Census 2010 Blocks are manually selected and added to the other extracted Blocks to complete the data set.
  Crosswalk tables are downloaded from
  http://www.census.gov/geo/www/2010census/rel_blk_download.html.
- Data sets are further processed by adding required fields based on the NTIA Data Model.

Road Segments
- If an ISP provides address-specific data, EDAC geocodes those points (using a process similar to that explained above in *Census Blocks*). The address points are aggregated spatially to Census Blocks, and the blocks with area greater than 2 sq mi (Area > 2 sq mi) are extracted. NM RCL roads within those Census Blocks are exported, and the geocoded address points are spatially joined with adjacent road segments within a distance of 25 ft (or 30 ft for rural areas). The road segments with joined address points are selected and exported.
- If an ISP provides road segment data with address ranges, any one of the address range values (TO/FROM) for the road is taken and the data are geocoded. Or, if no address ranges are provided, the address file is joined with the NM RCL roads, based on Street Name, City, and Postal Code and the matched records are extracted.
- If an ISP provides Tiger/Line roads data, those roads are extracted from the U.S. Census Tiger/Line shapefile by joining them based on the TLID (Tiger/Line ID). NM RCL road data that match the Tiger/Line roads are exported.
- If an ISP provides Telephone Exchange Boundaries or CO/RT locations or Cable service area boundaries, road segments for these data sets are not processed due to uncertainty about the NMBB procedures for these cases. EDAC checks for ISP-provided address-specific data and, if those data are present, processes the data using the first-listed *Road Segments* step. Otherwise, those roads are not further processed. NM DoIT and EDAC will request clarification from NTIA.
- Data sets are further processed by adding required fields based on the NTIA Data Model.

Community Anchor Institutions
- EDAC created an Anchor Geodatabase that has data on all the Community Anchor Institutions, such as Schools, Libraries, Health Care, Higher Education, Public Safety Facilities, Government Agencies, and Non-governmental Institutions throughout the State of New Mexico. These data were obtained from different sources, including the Public Schools Facilities Authority (PSFA),

New Mexico State Library, Homeland Security Information Program (HSIP), and NM Resource Geographic Information System Program (RGIS).

- The Anchor Geodatabase is further processed to meet the NTIA requirements. NCES IDs for schools, IPEDS IDs for higher education, and IMLS IDs for libraries are obtained from the respective Web sites and are joined with records in the geodatabase.
- Broadband data provided by the ISPs are also included in the geodatabase. EDAC uses the third-party USAC (Universal Service Administrative Company) data set for broadband information for Schools and the NM State Library data set for broadband information for Libraries.
- Data sets are further processed by adding required fields based on the NTIA Data Model.

Wireless

- If an ISP has multiple spectra, the provided polygon is duplicated for each spectrum and then appended together to obtain a single shapefile with stacked geometry.
- If an ISP provides tower location (address or coordinates) and transmit radius instead of shapefiles, those locations are mapped and a buffer is drawn with the transmit radius.
- Data sets are further processed by adding required fields based on the NTIA Data Model.

Overview

- This set of notes applies to wire-line data, only.
- If an ISP provides the Subscriber Weighted Nominal (SWNOM) Speed of respective technology types for the counties it serves, those values are joined with the County boundary file from the U.S. Census Tiger/Line shapefiles.
- If an ISP provides the technology of transmission, number of subscribers, and the maximum advertised speed for the Counties it serves, the SWNOM Speed is calculated and the values are joined with the County boundaries shapefile.
- These county files from each ISP are appended together to obtain a statewide stacked geometry. Data are further processed by adding required fields based on the NTIA Data Model.

GIS Data Verification, Updates, and Edits

Processed data are developed as Provider-specific spreadsheet and GeoPDF products. As the first step in New Mexico's Provider feedback loop, EDAC places each Provider's products on the SFTP site and requests that Providers verify accuracy and identify needed edits and corrections. Seven (7) ISPs responded to the verification request in the October 1, 2011 data submission cycle.

GIS data are updated and edited, based on Provider feedback, and modified data products (spreadsheet and GeoPDF) are delivered to the Provider through the SFTP site for final verification and to complete the feedback loop.

NTIA Geodatabase Preparation

EDAC produces a final "clean" GIS data set from the processed and Provider-specific, versioned feature data sets, and then prepares the NTIA Geodatabase from these finalized GIS data. Crowd sourced data were not used for preparation or validation.

NTIA Geodatabase Validation

EDAC validates the geodatabase by performing the validation checks provided below and by running the geodatabase through the SBDD_CheckSubmission tool. EDAC then assigns Quality Assurance/Quality Control (QA/QC) values.

- Repair Geometry.
- Validate Topology.
- Check Provider identification fields by Frequency tool and Summarize tool.
- Check for Null values in Transmission Technology codes, PROVIDER_TYPE, FULLFIPSID, STATEFIPS, COUNTYFIPS, TRACT, BLOCKID fields.
- Check for Null values in TRANSTECH, ANCHORNAME, ADDRESS (BLDGNBR, STREETNAME), CITY, ZIP5, STATE, GEOUNITTYPE, STATECOUNTYFIPS fields.
- Check Maximum advertised and typical down/upload speed fields for null values and for valid domain values. MAXADDOWN/TYPDOWN < MAXADUP/TYPUP; MAXADDOWN < '0' OR MAXADDOWN > '9'.
- Check for SPECTRUM values <1 and >10.

NMBB Report and Submittal

Finalized NTIA Geodatabase and Metadata

EDAC finalizes the Geodatabase per NTIA standards (National Broadband Map Data Transfer Model V1.0.2) and creates the associated metadata.

NMBB Program Manager

The NMBB Program Manager receives the finalized Geodatabase through the SFTP site and approves the files for submittal to NTIA. The finalized Geodatabase was uploaded for review and approved on September 26.

EDAC completes and delivers all files to the NMBB Program Manager, as required by the Program. Files include correspondence logs with NM Providers, documentation for Web mapping activities, and the Provider-specific Data Processing Tracking Form.

NTIA Submittal

The Geodatabase and required files (data transmittal memorandum, Provider data request template [not a required file], data package spreadsheet, check-submission receipt, methodology, and changes and corrections) are uploaded, using the FCC/NTIA SFTP site.

NMBB Map Layers

EDAC creates GIS map layers from the Geodatabase and publishes them to the New Mexico Broadband Program Mapping site, www.nmbbmapping.org/mapping/.

Response: NTIA Submission Summary

NM DoIT and EDAC developed a document template to respond to the NTIA Submission Summary, both to address NTIA-identified issues or gaps and to request clarification and additional information. New Mexico responds within one week of receiving NTIA's Submission Summary.

NMBB System Security

System Security

The NM Broadband Server is a fully patched Windows Server 2008. The server is protected by Symantec Endpoint Protection and a double firewall.

The first layer of firewall protection is a Cisco hardware firewall that protects the Server from any intrusion from outside the EDAC network. This firewall only allows connections on Ports 80 and 22.
- Port 80 allows Web browsing.
- Port 22 allows Secure FTP. SFTP service is fully encrypted with SHA1 stored passwords.

The Windows software firewall is configured to allow access on Ports 80, 22, 443, and 3389.
- Port 443 gives EDAC developers the ability to configure ArcGIS Server from within the EDAC network.
- Port 3389 gives EDAC system administrators the ability to configure the base Windows server from within the EDAC network.

Server Connections

Connect to the Server from the outside:
- HTTP: No authentication (simple Web browsing).
- SFTP: Authentication required and fully encrypted.

Connect to the Server from within the EDAC network:
- HTTPS: Authentication required and fully encrypted.
- RDP: Authentication required and fully encrypted.
- SMB: Port 445, Windows file-share port.

Virtual Machine and Networked Drive Back-ups

The NMBB Virtual Machine (VM) is a dedicated server.

Back-up: Development Networked Drive (not published)
- Daily: A differential back-up to a tape server is performed; the tape server is connected to a secure tape library.
- Friday/Weekend: A full back-up of the networked drive is performed to the secure tape server.

Back-up: Virtual Machine (published)
- Daily: The entire VM is backed up by VDR (VMware Data Recovery [application]) to a secure, self-contained data store.

Physical Security

NM Broadband Server physical security is accomplished through:
- Controlled-environment floor space in a locked, code-protected room for system servers, and
- An uninterrupted power supply (UPS).

Lessons Learned

Provider Feedback Loop

During the April-2011 submittal process, EDAC identified and implemented several measures for more effective data collection. These included:

- Developing and formalizing an interaction process between data providers and EDAC.
- Modifying the data request template, based on the updated NTIA data model.
- Setting deadlines for receiving data from ISPs. This allowed EDAC sufficient time for processing and submitting feedback maps to ISPs for their verification.

These measures were successful with respect to efficient data processing and validation and for ISP engagement.

Data Validation and Processing

EDAC continued to address issues regarding data validation and processing. These included:

- Updating data validation procedures to meet the requirements of the data model.
- Researching and learning the propagation models for processing Satellite and Wireless data.

NMBB Web Map

The New Mexico Broadband Map (www.nmbbmapping.org/mapping/) is developed as part of the NMBB Program for the State of New Mexico. This Web map displays all of the processed ISP broadband data that are submitted to NTIA for the National Broadband Map, and the processed statewide satellite-service data.

Figure 2, below, is a screen-capture image of the New Mexico Broadband Map V 2.0 showing DSL, Cable, and Copper Wire broadband-coverage layers on the Streets base map. Satellite and Mobile Wireless layers are not displayed. Tools include: layer selection; base map selection; dynamic legend; slider-bar and custom zoom; drag-and-drop and directional pan; full, previous, and next extent; identify; find address; scale bar; and print map. Additionally, a feedback tool, help (online user guide), program information, and New Mexico's disclaimer are provided.

Version 2.0 includes enhancements to the Identify tool, which allow the user to identify ISPs by technology type, and addition of the Data Update: <data submittal date> in the application title.
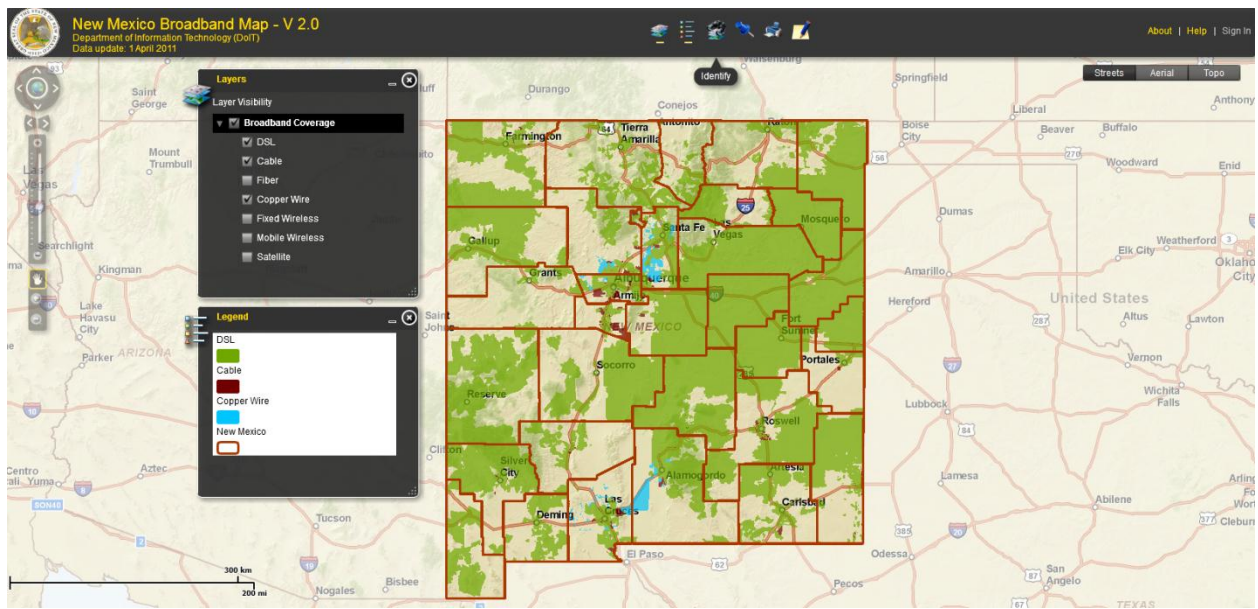
Figure 2 NMBB Program: New Mexico Broadband Map, www.nmbbmapping.org/mapping/; accessed 27 September 2011

Table of Abbreviations and Acronyms

API	Application Programming Interface
BB	broadband
CAD	Computer-aided Design
CO/RT	Central Office/Rural Terminal
DBA	Doing Business As
DoIT	[NM] Department of Information Technology
DSL	Digital Subscriber Line
EDAC	[UNM] Earth Data Analysis Center
FCC	Federal Communications Commission
FGDC	Federal Geographic Data Committee
FRN	FCC Registration Number
ft	foot
FTP	File Transfer Protocol
GDB, gdb	Geodatabase; Geodatabase file extension
GIS	Geographic Information Systems
HSIP	Homeland Security Information Program
HTTP	Hypertext Transfer Protocol
HTTPS	Hypertext Transfer Protocol Secure
ID	[unique] identifier
IE	[Microsoft] Internet Explorer
ISP	Internet Service Provider
NDA	Non-Disclosure Agreement
NM	New Mexico, State of New Mexico
NMBB	New Mexico Broadband Program
NM DoIT	New Mexico Department of Information Technology
NOFA	Notice of Funding Availability
NTIA	National Telecommunications and Information Administration
PDF, pdf	[Adobe] Portable Document Format and file extension
QA/QC	Quality Assurance/Quality Control
RCL	[NM] Road Centerlines
RDP	Remote Desktop Protocol
SBI	State Broadband Initiative
SFTP	Secure File Transfer Protocol
SHA1, sha1	Secure Hash Algorithm 1
SMB	Server Message Block
sq mi	square mile(s)
SWNOM	Subscriber Weighted Nominal [Speed]
TIGER	[U.S. Census] Topologically Integrated Geographic Encoding and Referencing (system)
TXT, txt	Text file extension
UNM EDAC	The University of New Mexico Earth Data Analysis Center
UPS	uninterrupted power supply
USAC	Universal Service Administrative Company
VDR	VMware Data Recovery (application)
VM	Virtual Machine
Web	World Wide Web
XLS, xls	Microsoft Excel file extension
ZIP, zip	Zipped file extension