5.10   PERFORMING SERVICE BACKUP WITH THE
INTERACTIVE FORECAST PREPARATION SYSTEM

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1. INTRODUCTION

The National Weather Service (NWS) is implementing the Interactive Forecast Preparation System (IFPS) on its Advanced Weather Interactive Processing System (AWIPS). IFPS allows forecasters to produce a suite of products from a digital database which is initialized with model data. The forecaster can use a variety of interactive tools to modify the digital data (Ruth et al. 1998). IFPS techniques can produce products in gridded, graphical, tabular, and text formats (Peroutka et al. 1998).

IFPS forecast data are stored within the digital database as grids and Digital Forecast Matrices (DFM). Grids allow the forecaster to view a single element over an area for a point or span of time. DFMs represent a forecast at a single point or an ensemble of grid points. The DFM provides data for every element at 3-h intervals.

NWS Weather Forecast Offices (WFO) will produce nearly all routine forecast products from the digital database. These products need to be issued even when the originating WFO is unable to provide this service. This paper describes the set of IFPS techniques an NWS WFO will use to generate products for a neighboring WFO. Implementation will be in 2002.

2. SERVICE BACKUP

WFOs are assigned County Warning and Forecast Areas (CWFA) for which they provide forecast and warning services. Occasionally, a WFO is unable to perform its duties due to system failures, routine maintenance, and various other reasons. In these cases, one or more neighboring WFOs provide "service backup" and issue the products for the failed WFO. The terms "failed"

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and "backup" are used to denote sites involved with service backup. A failed WFO is a site that is no longer able to create and issue forecast products for its CWFA. A backup WFO is a site that assumes forecast responsibility for the failed WFO.

3. SERVICE BACKUP WITHIN IFPS

The IFPS Master Menu provides a framework for launching various applications and controlling data flow between grids and DFMs. The Master Menu also controls all aspects of service backup.

IFPS service backup capability is implemented by allowing a WFO to launch additional instances of IFPS. This means forecasters at the backup site navigate one IFPS Master Menu for the local forecast and one for the failed site. This implementation provides great flexibility in configuring which WFOs provide service backup. Each time a WFO enters service backup, additional databases are created and configured to match the database at the failed site. In this manner, all of the configuration data from the failed site are available to the backup WFO. This allows the characteristics of the resultant products to appear similar to the user, despite being issued by an alternate WFO.

In order to initiate service backup, the backup WFO must access the configuration data and gridded digital data for the failed WFO. To support this transfer of data, a central server, possibly located at the Network Control Facility, will be set up to act as a repository for configuration and digital data. Fig. 1 shows two WFOs operating in a non-service backup mode. Both of these WFOs periodically send configuration data to the central server in preparation for a potential service backup situation. Digital data can also be sent to the central server in the event of a planned service backup event.

When a WFO fails, the backup WFO accesses the central server to download the necessary configuration and digital data. Fig. 2 shows the interaction with the central server when service backup is initiated.
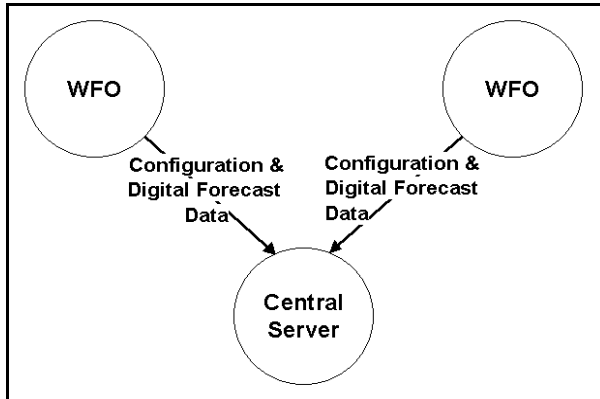
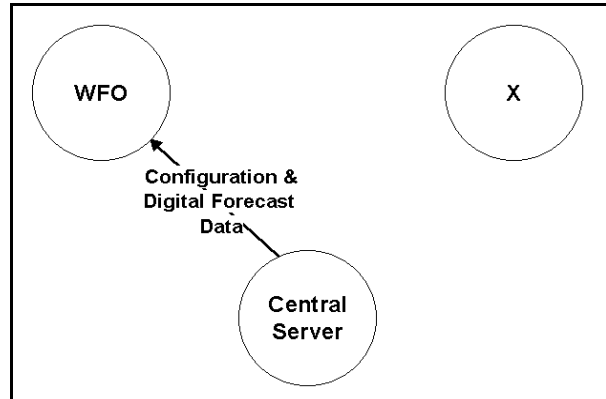Figure 1. Normal operations between WFOs and the central server.

Figure 2. Backup operations between WFOs and the central server.

4.   IFPS BACKUP SCENARIOS

There are two scenarios associated with service backup. The first one is a planned outage. In this scenario, a WFO knows in advance that it will not be able to carry out its operational duties. An example of this type of outage occurs when software is upgraded for AWIPS. The other scenario is an unplanned outage such as a communications failure. In this case, the WFO is unexpectedly unable to create and issue the routine forecast products.

4.1 *Planned Backup*

For a planned backup, the WFO coordinates the impending outage with the backup WFO. This allows the latest digital forecast and configuration data to be exchanged between the WFOs. The following steps are followed in this situation:

1.   The failing WFO notifies the backup WFO of a planned outage by telephone.
2.   The backup WFO imports the failing WFO's config-uration data from the central server.
3.   The failing WFO exports their digital forecast data to the central server.
4.   The backup WFO imports the failing WFO's digital forecast data from the central server.
5.   The backup WFO starts an additional instance of IFPS that supports the failed WFO's CWFA.
6.   The backup WFO creates and issues the suite of routine forecast products for the failed WFO.
7.   The failed WFO notifies the backup WFO by tele-phone when they are able to resume operations.

Steps 3 and 4 deal with the exporting and importing of the digital database. These two steps are reversed to help the failed site resume operations. The backup WFO exports the failed WFO's modified digital forecast data back to the central server and the failed WFO imports these data in order to resume normal operations.

4.2 *Unplanned Backup*

For an unplanned backup, the failed WFO follows the same basic steps as in the planned scenario. The exception is that the backup WFO does not have access to the latest digital forecast data from the failed WFO. This scenario results in additional work for the backup WFO. The digital forecast data must be fully initialized and modified by the backup WFO to create the routine forecast products.

5.   IFPS SERVICE BACKUP IMPORT AND EXPORT COMMANDS

In the proceeding two scenarios, several import and export actions are mentioned. The import and export commands that accomplish these data transfers are key to understanding how IFPS service backup works. A brief discussion of these commands follows.

5.1 *Export Configuration Data*

This export allows the failed WFO to provide the latest configuration changes to the backup WFO. These data are exported whenever modifications related to product generation are made. WFO staff performs this export by accessing the IFPS Configuration Menu (Fig. 3). When "Configuration Export" is selected the latest configuration data are packaged and transmitted to the central server. The IFPS Focal Point (IFPS-FP) is responsible for maintenance of the WFO's configuration data on the central server.

5.2 *Export Digital Data*

It is desirable for the failed WFO to export the current forecast gridded database. This assists the backup WFO with the preparation of products for the failed WFO. The digital data within the forecast database and the software version number are sent to the central server when the forecaster selects "Export Digital Fore-
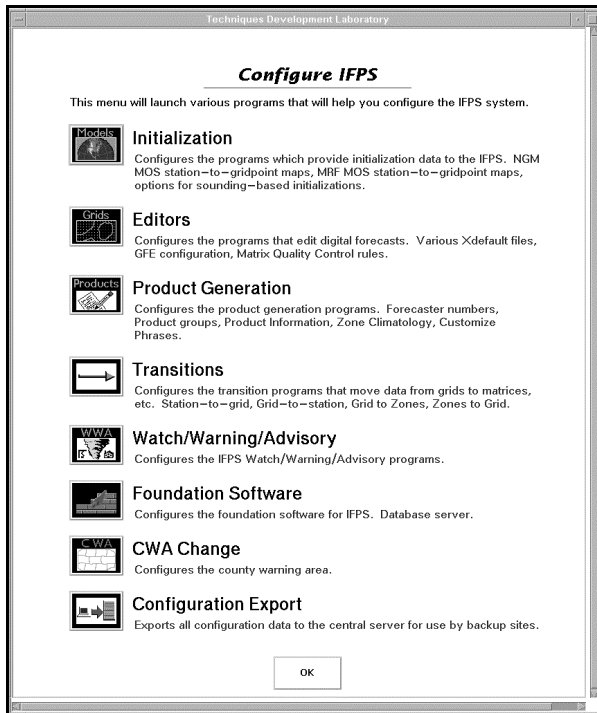
Figure 3. IFPS configuration menu.

cast" from the IFPS Master Menu (Fig. 4). This method allows a forecaster at a failing WFO to provide the backup WFOs with the latest forecast data. This simplifies the transition to backup mode during forecast preparation. This method of sending data to the central server is only used in a controlled backup scenario.

5.3 *Import Configuration Data*

Fig. 4 shows the selection used to import a failed WFO's configuration data to the backup WFO. This option is found on the IFPS Master Menu. When the "Import Configuration Data" option is selected, a request for the data is sent to the central server. Once the central server receives this request, the configuration data
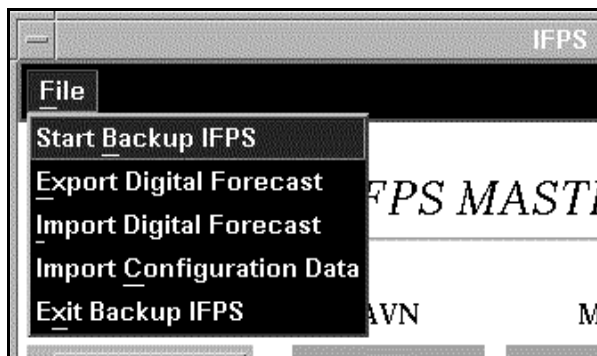

Figure 4. IFPS Master Menu file option.

exported by the failing site is imported to the backup WFO. The forecaster is notified when import of configuration data is complete. This informs the forecaster to proceed with the import of digital data from the failed site.

5.4 *Import Digital Data*

In order to use the latest forecast data from the failed WFO, the backup WFO must import the digital data from the central server (Fig. 4). Once the data arrives and is processed at the backup WFO, the forecaster receives notification that the IFPS Master Menu is ready to be started for the failed WFO. The IFPS Master Menu for the failed WFO is started via an option in the IFPS Master Menu. Once the IFPS Master Menu has been launched for the failed WFO, it is used in the same manner as during normal operations.

6. IFPS SERVICE BACKUP IMPLEMENTATION ISSUES

Implementing service backup within IFPS introduces two technical issues. These issues are software version control and product formatting.

6.1 *Software Version Control*

IFPS software is periodically upgraded. Therefore, the IFP service backup software must be able to resolve version differences in the relational and gridded databases. The software version differences are often due to changes in Commercial Off the Shelf (COTS) software or IFPS file/database format changes. In each of these situations, IFP service backup software needs to ensure that the backup WFO software and database are compatible with the failed site's configuration and digital data.

The version differences are resolved on the central server. When WFOs send the configuration and digital data to the central server, the software version number is also sent. The requesting site's version number is compared with the one stored by the failed site. If the version numbers differ, the failed site's data are adjusted to match the software and database version at the requesting site.

6.2 *Product Formatting*

NWS policy requires products issued by backup WFOs have a format similar to those issued by the failed WFO. WFOs determine the overall characteristics of the forecast products by adapting to the national, region, and local policies. For example, the WFO determines which stations are included in the temperature and probability of precipitation tables that can be included in the Zone Forecast Product. This type of configuration information differs between the WFOs. These differences need to be preserved during service backup. The one difference in the text forecast products are that the product header

must contain an additional line identifying the backup office. Fig. 5 shows a portion of a product issued by backup office. The additional line is formatted as, "ISSUED BY NWS BLACKSBURG VA."

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FPUS51 KRLX 241502
ZFPRLX

ZONE FORECASTS FOR THE CENTRAL APPALACHIANS
AND MIDDLE OHIO VALLEY
NATIONAL WEATHER SERVICE CHARLESTON WV
ISSUED BY NWS BLACKSBURG VA
1100 AM EDT MON SEP 24 2001

WVZ005>007-242030-
CABELL WV-MASON WV-WAYNE WV-
INCLUDING THE CITIES OF...
HUNTINGTON WV
1100 AM EDT MON SEP 24 2001


.THIS AFTERNOON...CLOUDY WITH A CHANCE OF
SHOWERS. TEMPERATURES NEARLY STEADY IN THE
LOWER 60S. SOUTH WIND 5 TO 10 MPH BECOMING
WEST. CHANCE OF RAIN 40 PERCENT.
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Figure 5. ZFP containing service backup header.

Another product formatting issue is the Tabular State Forecast Product (TSFP). The TSFP is produced by one office per state. This product is based on Coded Cities Forecasts (CCF) from all of the WFOs within a given state. WFOs which do not normally produce the TSFP are not gathering the necessary information from the CCFs in order to create the TSFP. In backup mode, a modified version of the TSFP software which gathers the CCF data at product formatting time is used.

7. CONCLUSIONS

As the NWS moves into the IFPS era of routine forecast product generation, IFPS service backup becomes increasingly important. IFPS service backup allows the NWS to maintain a high level of product consistency and detail even when a neighboring WFO fails. Implementation of the described capability in 2002 is only a beginning in providing a more comprehensive service backup which will relieve the forecaster of initializing the failed WFO's database in order to issue that WFO's products.

8. REFERENCES

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Ruth, D. P., M. A. Mathewson, T. J. LeFebvre, and P. K. Wu, 1998: Interpretation and editing techniques for Interactive Forecast Preparation. *Preprints 14th International Conf. on Interactive Information and Processing Systems for Meteorology, Oceanography, and Hydrology*, Phoenix, Amer. Meteor. Soc., 345-349.