

# The Multi User Administration Guide

October 1999



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## 1. Purpose of this Document

This document contains everything there is to know about the Multi User Shapefile functionality incorporated into Linnet's Powerpack Application. Reading this document will give you an in-depth understanding of how the Multi User Shapefile functionality works. Understanding the processes behind the Multi User functionality will help with administering and supporting new and existing systems, as well as recovering after data corruption.

## 2. Understanding the Problem

A fundamental limitation of ArcView shapefiles is that they do not allow for more than one person to edit them at the same time. If more than one person starts editing a shapefile at the same time, the shapefile will most likely become corrupt, often resulting in total loss of all data within the shapefile. Further, users who are viewing a shapefile that is being edited by another user may receive error messages unexpectedly when they do something as simple as a zoom operation.

Unfortunately, in most large scale GIS applications, there is usually the need to allow many people to edit the database at the same time. Most often, the problem can be solved by dividing the database up into many shapefiles, reducing the chances that more than one person would ever be editing the same shapefile at the same time. However, this is not an optimal solution.

In version 3.0 of ArcView, a 'lock manager' was introduced to address some of these problems. The lock manager (if installed) will prevent more than one user from editing a shapefile at the same time – the second user will be locked out (unable to edit). Without the lock manager, both people will be allowed to start editing, and the shapefile will be corrupted. In addition, users who are viewing the shapefile that is being edited have to remove the theme from their view before the person editing it can save their changes. So the lock manager is still less than ideal.

## 3. The Solution

The solution to the problem is to achieve multi user editing through a complex series of application programs. All the programs revolve around one basic principle: *a user never views or edits the original shapefile; they always view/edit a copy of the shapefile*. The original shapefile is referred to as the 'MASTER', and the copy is referred to as the 'CLONE'.

In general, multi user editing works as follows:

- The user adds a multi user shapefile to the list of open themes using Navigator. When they click on the OK button in Navigator, the user's workspace (GIS\_WKSP) is searched for a Clone version of the shapefile, and then inserts the Clone into the view. If it is the first time loading this particular multi user theme, a Clone version of the theme will not be found in the user's workspace. In such a case, Navigator will create a Clone by copying the Master version of the shapefile to the user's workspace. This is all transparent to the user.
- If the user simply wishes to add new features to the shapefile, they may do so now using either standard ArcView tools and/or custom application tools.
- If the user wishes to modify or delete an existing feature in the shapefile, they must first lock the feature, and then make the edit. When features are locked, no other users can edit them.
- When all the new features have been added, and any desired edits made, the changes are posted to the Master shapefile.

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- Viewing changes made by other users that have been posted to the Master shapefile, is accomplished by performing a refresh on the theme.
  - When a theme is refreshed, all changes posted to the Master by other users since the last refresh will be copied to the Clone shapefile. The refresh options are available in menus, and are run automatically when the user exits Designer, or starts the application.

No one, including an Administrator, should ever attempt to access the Master shapefile directly by adding it (or its attribute table) to an ArcView project. Always view and edit the shapefile using Navigator and multi user editing tools.

## **4. Administering Multi User Shapefiles**

Multi user enabled shapefiles can be administered using various tools available throughout the system.

### **4.1. Creating a Multi User Theme**

For a theme to be 'Multi user' enabled, it must have a shapefile data source. The multi user functionality does not support Images, Grids, ArcInfo Coverages, Cad data sources, etc.

A shapefile datasource can only be multi user enabled once. Should any additional Navigator themes require the data contained in this shapefile, the Clone version should be used as the datasource. For more information see 'Improper Uses'. (Sec 5.1.4.)

#### **4.1.1. Source Data Location**

In order for a shapefile to be multi user enabled it must first exist as a theme in Navigator. When a Navigator theme is multi user enabled, the Master datasource will be the shapefile as it was originally defined in Navigator. Make certain that the Navigator theme is stored on a drive accessible by all users using the same path.

- 'C:/Temp/Roads.shp' stored on your local drive would not be an acceptable location for a multi user theme datasource. This is because not all users will be able to find this same datasource in their 'C:/temp' directory
- 'N:/GIS/ArcViewData/Shapefiles/Roads.shp' stored on a server common to all users would be an acceptable location to store a multi user theme datasource.
- All users must have 'Read/Write' access the Master shapefile.

#### **4.1.2. Enabling Multi User Functionality**

It is advisable to make sure that nobody is currently viewing the shapefile. If someone does have the shapefile in their view, have them remove it.

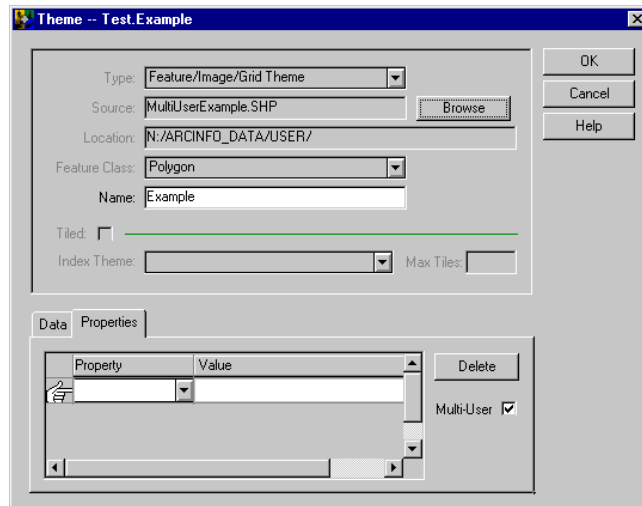
To make an existing Navigator theme Multi User enabled using Navigator Admin, you must have Administrator Privileges. Once a user has Administrative Privileges, there are 2 ways to make a Navigator theme Multi User accessible:

- Using Navigator Admin
- By selecting the 'Make Shapefile Multiuser...' menu choice from the 'Admin' menu.

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#### 4.1.2.1. Navigator Admin

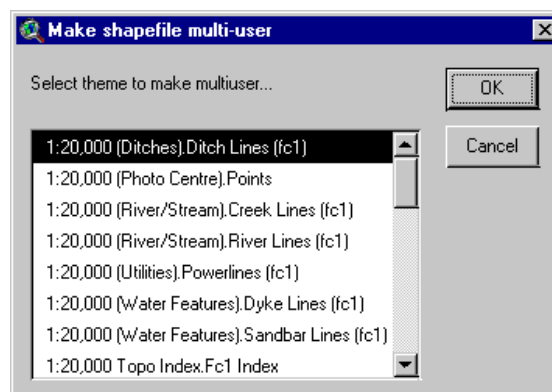
In the Admin menu select 'Navigator Admin'. The 'Navigator Admin' dialog window will appear. In the Tree View, locate the theme that is to be multi user enabled and select it. Click the 'Edit' button that appears at the side of the dialog and the Edit Theme dialog appears.



From the 'Properties' tab at the bottom of the dialog click the 'Multi User' check box. When 'OK' is clicked the theme will be multi user enabled.

#### 4.1.2.2. 'Make Shapefile Multiuser...' Menu Choice

From the 'Admin' menu select 'Make Shapefile Multiuser...' and the following dialog will appear:



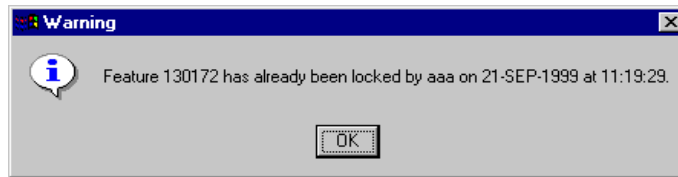
The dialog contains a pick-list of all of the themes currently defined in Navigator that are not multi user enabled. Simply select the theme that is to become multi-user enabled and click 'OK'.

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## 4.2. Locking Features

Features are automatically locked for any user when editing shapefiles within Powerpack, whether it be in a Designer or Navigator environment. But there are occasions that an administrator may wish to lock certain features manually.

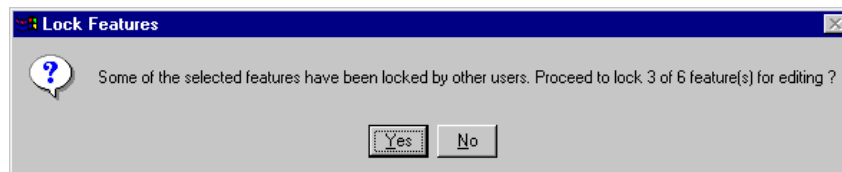
- To lock features manually, simply select the features in the active multi user enabled theme that are to be locked.
- From the Admin menu select 'Lock Features'.
- Any of the features selected that have already been locked by other users will be reported. In this example, user 'aaa' already had one of the features locked.



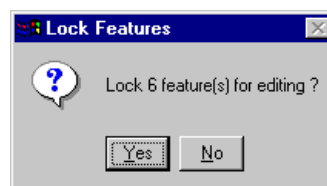
- Any of the features selected that have since been deleted by other users will be reported. In this example, user 'bbb' deleted feature with Record\_Num = 203. Refreshing the theme will delete this feature from the Clone shapefile.



- Searching for 'DELETED' features requires that the system search through all previous Post transactions. If the 'Edit History' has not been 'Purged' and allowed to store Post transactions a long time, this search could take an unreasonably long period of time. (Sec 4.7.)
- If not all of the selected features can be locked by the current user, a prompt will appear to confirm that only a sub-set can be locked.



- If all of the selected features can be locked, a confirmation prompt appears:



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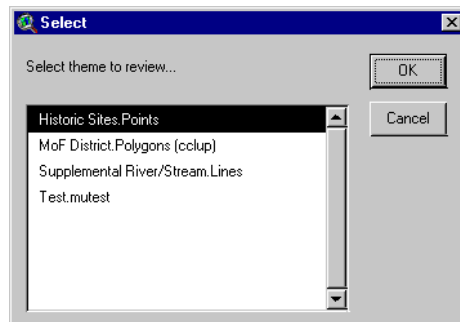
## 4.3. Removing Locks

There may be instances where it may be necessary to remove a lock placed on either a theme or feature. Administrative privileges are required to ‘unlock’ a feature or theme.

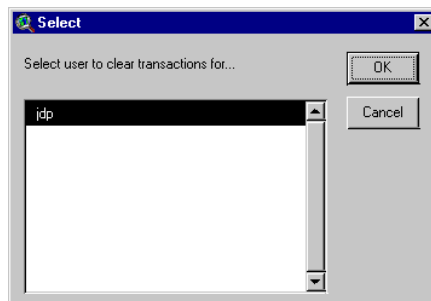
### 4.3.1. Remove Feature Locks

One of conditions of a Post operation is for one or more features to be locked by the current user. Removing a feature lock could potentially cause an unposted modification in a user’s Clone shapefile to get lost. Removing Feature locks is therefore only run when absolutely necessary. Obviously, it would be a very good idea to first confirm the removal of the lock with the user that placed it.

- The names of any themes possessing a locked record are displayed when the user chooses ‘Clear Outstanding Transactions...’ from the Admin menu.



- Select the theme to remove the locked records from and click ‘OK’. The following dialog appears displaying the user\_ids currently maintaining a feature lock in the theme:



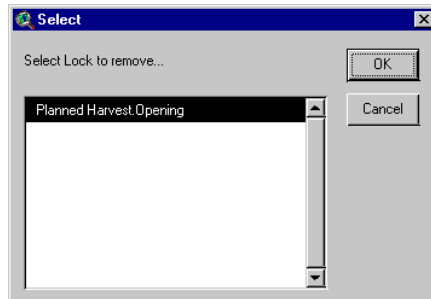
- Select the desired user name and click ‘OK’. All records locked in the theme by the selected user will now be released.

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### 4.3.2. Remove Theme Locks

When a multi user enabled theme has been locked by a user, it implies that the Master shapefile is currently being edited. Removing a theme lock could allow a user access to a Master shapefile while the theme is being edited. Such a scenario would be likely to cause the Master shapefile to become corrupt. Manually removing theme locks should only be necessary under extremely rare circumstances. For those rare occasions, a user with administrative privileges should have little trouble removing the lock.

- First, consult with the user that placed the lock to ensure that the lock can be removed. This is imperative as the user may have the theme locked for a reason.
- From the Admin menu select 'Remove Theme Lock' and the following dialog appears:



- All currently locked themes will appear in the listbox.
- Select the theme to 'Unlock' and click 'OK'. The theme lock has now been removed.

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## 4.4. Posting Features

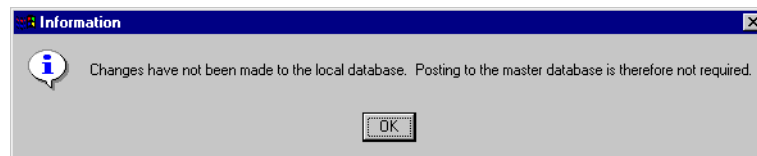
Anytime a user locks a feature it is assumed that a change is going to take place. Any changes must be copied back to the Master shapefile; this is referred to as a POST operation. Post operations normally occur automatically when Designer is exited. There are some cases where it may be necessary to initiate a Post operation manually.

### 4.4.1. Conditions of a Post

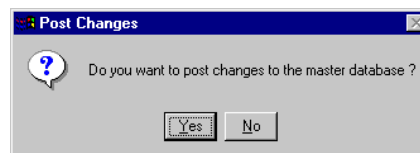
- One or more Features are locked in the Clone shapefile.
- One or more newly created features exist in the Clone shapefile. Newly created features that have not yet been posted to the Master shapefile will have a Record\_Num = '0'.

### 4.4.2. To Perform a Post Manually

- Identify the theme containing the features to be posted and make it the only 'active' theme in the view's Table of Contents.
- From the Admin menu select 'Post Features'.
- If the following message appears, it means that there are no features currently locked by the current user and no newly digitized features that have yet to be posted existing in the active multi user enabled theme.

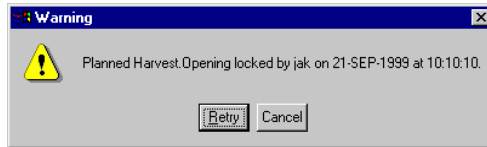


- Should the above message appear and a Post operation is still desired, lock the features that are to be posted and attempt the Post again.
- If a Post operation is required the following message will appear:



- Clicking 'YES' will initiate the Posting process.
- A check is made to ensure that the Clone shapefile is not corrupt.

- If the theme is locked by another user, the system will continuously retry placing the lock for a specified amount of time (set using 'Powerpack System Setting...' dialog). If after the defined waiting period the lock placed by another user still exists, a message similar to the following will appear:

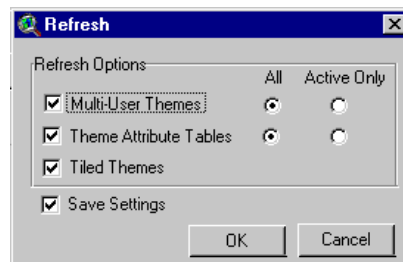


- Clicking 'Retry' will tell the system to continue attempting to gain access to the Master shapefile. The time the system waits between user prompts is configured using 'Auto Retry Time Limit' in the 'Powerpack System Settings'. (Sec. 4.6.)
- When a 'locked message' appears, pay close attention to the time and date that the theme was locked. If it appears that the Master shapefile has been locked for many days, perhaps the THEME lock must be removed manually.
- Clicking 'Cancel' stops the process. The user can attempt a Post operation again later on.
- Once the theme is locked by the current user, the Master shapefile is backed up (Sec. 4.6.3.)
- Changes are copied from the Clone shapefile to the Master shapefile.
- The Theme Lock is removed.
- The Feature Locks are removed.
- All Post transactions are stored in the 'Edit History'. (Sec 4.7.)

#### 4.5. Refreshing a Theme

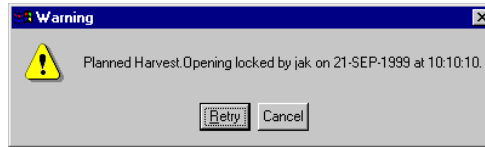
A 'Theme Refresh' refers to the process by which changes made to the Master shapefile are copied to the Clone shapefile. Administrative privileges are not required to manually invoke the Refresh process.

- From the View menu select 'Refresh...'. The following dialog will appear.



- Make sure that the 'Multi-User Themes' check box is checked. Click 'OK'

- If the theme is locked by another user a message much like the following will appear:

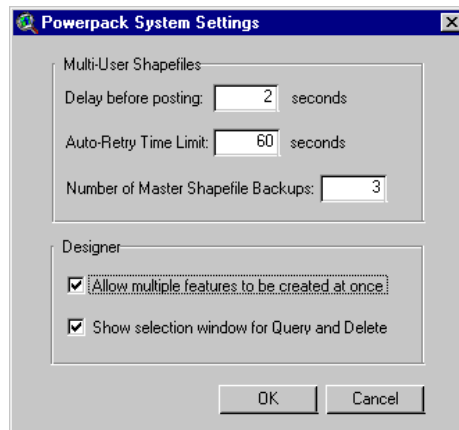


- Clicking 'Retry' will tell the system to continue attempting to gain access to the Master shapefile. The time the system waits between user prompts is configured using 'Auto Retry Time Limit' in the 'Powerpack System Settings'. (Sec. 4.6.)
- Pay close attention to the time and date that the theme was locked. If it appears that the Master shapefile has been locked for many days, perhaps the THEME lock must be removed manually.
- Clicking 'Cancel' stops the process. The user can attempt a Refresh operation again later on.
- Once the theme lock has been placed by the current user, the Clone shapefile is refreshed from the Master shapefile.
- The lock on the Master shapefile is removed.

## 4.6. Setting System Defaults

The multi user Post and Refresh operations allow for some degree of system customization. Customized settings are set by a user with administrative privileges by selecting 'Powerpack System Settings...' from the Admin menu.

- When 'Powerpack System Settings...' is selected from the Admin menu, the following dialog appears:



### 4.6.1. Delay Before Posting

Once a theme has been locked for editing, the system does not immediately open the data source file for editing. Adding a delay time ensures that the Master shapefile has been successfully closed by the preceding transaction.

The 'Delay Before Posting:' value sets the number of seconds the system will wait from when a Theme lock is placed until the Master shapefile made editable. Values can range

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anywhere from 1-10 seconds depending on the speed of the system. The faster the system the lower the value can be set.

#### 4.6.2. Auto-Retry Time Limit

When an attempt to lock a theme is made, it is not uncommon to find the theme already locked by another user. In such an instance, the system will check every 5 seconds to see if the existing lock has been removed. If after a certain amount of time has passed and the user is still unsuccessful at placing a theme lock, the user will be prompted whether to keep attempting to place the lock or to simply cancel.

The 'Auto Retry Time Limit' defines how long to continuously attempt to apply a theme lock before the user is prompted whether or not to continue.

A value anywhere 5 – 60 seconds is normal. Keep in mind that prompting too often can be annoying to any user.

#### 4.6.3. Number of Master Shapefile Backups

Every time the edits are posted to the Master shapefile, the Master shapefile is backed up. The number of back-ups created is set in the 'Number of Master Shapefile Backups' textbox in the dialog. When the number of Master shapefile backups generated reaches the maximum value, the first backup is overwritten.

Master shapefile backups are stored in the same directory as the Master shapefile itself. Each backup is named by taking the name of the shapefile source and appending the backup number to it. For instance consider the Master shapefile "P\_OPEN.SHP":

Name:	Modified:
P_OPEN.SHP	9/22/99 9:45 AM
P_OPEN.SHX	9/22/99 9:45 AM
P_OPEN.DBF	9/22/99 9:45 AM
P_OPEN1.SHP	9/22/99 9:33 AM
P_OPEN1.SHX	9/22/99 9:33 AM
P_OPEN1.DBF	9/22/99 9:33 AM
P_OPEN2.SHP	9/20/99 10:22 AM
P_OPEN2.SHX	9/20/99 10:22 AM
P_OPEN2.DBF	9/20/99 10:22 AM
P_OPEN3.SHP	9/20/99 2:34 PM
P_OPEN3.SHX	9/20/99 2:34 PM
P_OPEN3.DBF	9/20/99 2:34 PM

- In the above example the 'Number of Shapefile Backups' has been set to '3'.
- By examining the 'Modified:' property of each of the files it is evident that the most recent back up is 'P\_OPEN1.SHP'. This implies that the Master shapefile has been Posted to at least '4' times: 1, 2, 3, 1.

The number of shapefile backups created can be infinite. When administering this setting, be mindful of the fact that each file backup will take up space on the hard drive. This setting is universally applied to all multi user enabled themes managed by the system.

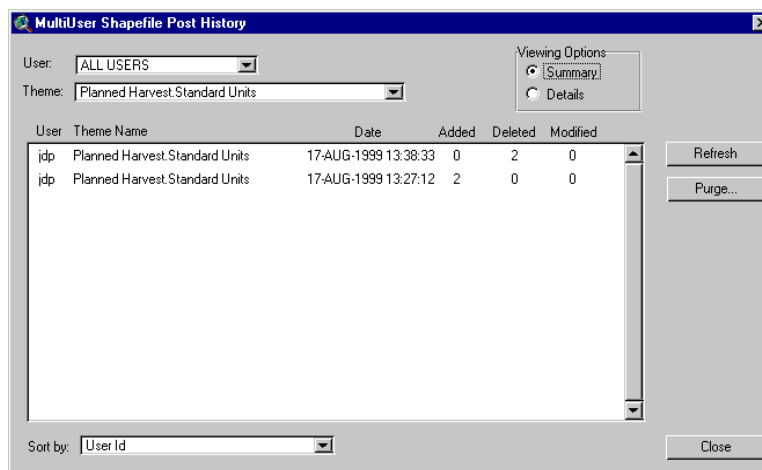
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Consider the largest multi user shapefile that exists and use it as a guide as to how many backups are required. Under normal conditions between 1 and 3 backups will suffice.

#### 4.7. Edit History

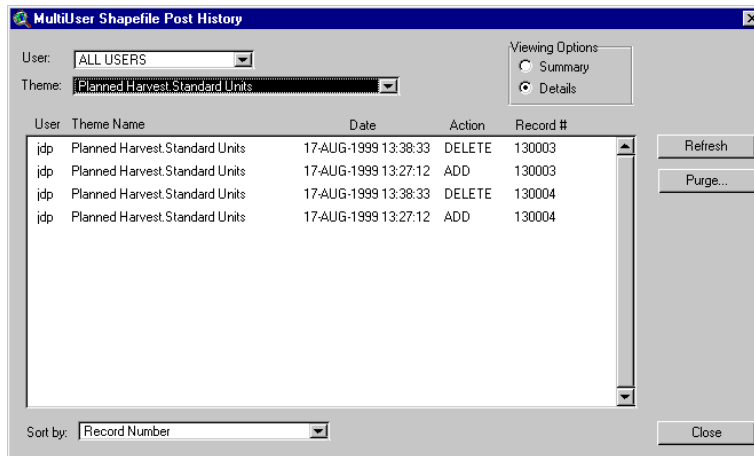
Every Post transaction will have an entry that can be found in the Multi User Shapefile Post History dialog. This dialog allows the user to view past Post transactions by User\_id, Theme, Action ('Add', 'Delete', 'Modify'), Record\_Num value and Date. Transactions can be viewed by Post transaction (Summary) or individually by Record\_num (Details). The Multi User Shapefile Post History dialog should allow an administrator the ability to trace the existence of any multi user enabled theme feature within the system.

This dialog is available in Long Menus by selecting the 'History' choice found under the Edit menu. Consider the following example:



- From the 'Multi User Shapefile Post History' dialog it is evident that 2 items were Added by 'jdp' to the 'Planner Harvest.Standard Units' theme on August 17, 1999 at 1:27 pm.
- Although it is not evident exactly which features were involved, it is evident that 2 items were Deleted August 17, 1999 at 1:38 pm.

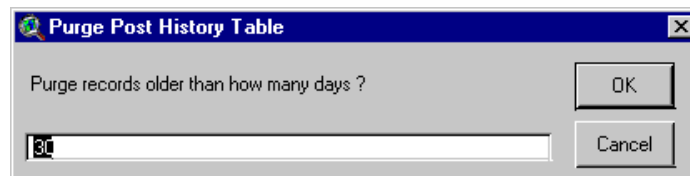
- By clicking the 'Details' radio button in the View Options the same information can be viewed in a slightly different manner:



- User 'jdp' added feature with Record\_num = 130003 to the 'Planned Harvest.Standard Units' theme on August 17, 1999 at 1:27 pm. This same feature was deleted by 'jdp' 11 minutes later.

Notice that the Record\_num values in the above examples are in the 13000's. If Record\_num values start at '1' where are the missing values? In this example, the other features may have been added by other users. What is more likely however, is that all of the old entries have been 'Purged'.

- To 'Purge' items from the 'Edit History', click the Purge button on the MultiUser Shapefile Post History dialog. The following dialog will appear:



- It is not necessary to store every Post transaction ever performed. How far back records are maintained is entirely up to the user.
- Keep in mind that Feature Locking functionality will use these records to determine whether or not an item in a Clone shapefile has been deleted from the Master since the last time the Clone was refreshed.
- Searching for 'DELETED' features requires that the system search through all previous Post transactions. If the 'Edit History' has not been 'Purged' and allowed to store post transactions for a long time, this search could take an unreasonably long period of time.
- In general, it is recommended that records older than 30 days be purged

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#### **4.7.1. A Word About Record\_Num Values**

Record\_Num values are sequence numbers generated by PowerPack. These values are not used or accessed by any other portion of the application (ie, PowerBuilder, or any part of the business portion of application). The business portion of the application usually maintains a unique identifier key, which is also stored in the shapefile. The multi user shapefile functionality ignores these values.

When examining the 'Edit History', be aware that the 'Record\_Num' values refer only to the 'Record\_Num' field values of the multi user enabled shapefiles.

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## 5. Trouble Shooting

The following is a catalog of problems that have been encountered using multi user enabled themes. Where possible step by step solutions are presented.

### 5.1. Improper Use

Under normal day to day conditions, the multi user functionality will perform properly. There are however, situations that can cause problems. Being aware of these situations before they occur will ensure that they do not occur.

#### 5.1.1. 'Musical Chairs'

It is assumed that with normal use of Powerpack, each user will be using the same computer (thus, workspace) and set of Cloned shapefiles. Problems may start to occur when there is a mixing and matching of users and machines. This is because Clone shapefile refreshes are managed by user\_id, not computer.

Consider the following example:

- User 'aaa' logs on to their own computer (NT).
- Using the computer logged in as 'aaa', user 'bbb' starts the GIS and logs into the GIS as 'bbb'.
- User 'bbb' is therefore using the workspace on the local computer, which actually belongs to 'aaa'. At this point, all of the Clone shapefiles existing the workspace represent Posts and Refreshes done by user 'aaa'.
- User 'bbb' adds a couple of features to one of the Clone shapefiles in the workspace and Posts them to the Master. User 'ccc' then performs a Refresh on the Clone shapefile to copy any changes made to the Master shapefile.
- User 'bbb' then exits the GIS system.
- Powerpack now contains a record that states *'user 'bbb' has an up to date Clone as of the current date/time'*. However, this record is referring to the Clone existing in the workspace of user 'aaa', not 'bbb'.
- User 'bbb' now logs into their own computer (NT) using their own login ID. User 'bbb' once again starts the GIS system and logs in as 'bbb'.
- User 'bbb' is now using their own workspace full of their own Clone shapefiles.
- The database states that the Clone shapefile mentioned above is completely up to date. However, the Post and Refresh operations were actually done on Clone shapefiles belonging to user 'aaa'.

The end result is features being Posted and Refreshed to the wrong Clone shapefile. This could also result in changes made in a Clone shapefile not being posted to the Master shapefile or Changes in the Master not being refreshed back to the proper Clone.

This is an extremely difficult situation to rectify properly. The Edit History file only stores transactions by user\_id, not by computer, which makes tracing a particular feature in this scenario near impossible.

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The only solution would be for the Administrator to determine what the current Master shapefile should look like. This may require sorting through the Master shapefile backups (if the problem is discovered quickly enough), and/or forcing certain features to be Posted from various Clone shapefiles by locking them manually and performing a Post operation. Once the Master has been restored to the proper state, delete the Clone shapefile from the workspace of each user. This will force the Master shapefile to be recopied from the network server to the workspace.

### **5.1.2. ‘Identity Crisis’**

The system assumes that no 2 users will have the same user\_id. If more than one user logs in with the same user\_id value Powerpack will become extremely confused and the multi user functionality will be rendered ineffective. For instance, locks placed by a user at both the RECORD and THEME level will no longer deny access to other users because Powerpack will think it was them who placed the lock. In the case of a RECORD lock being ignored, changes made by one user may be overridden by shapes existing in the Clone shapefile held by another user. In the case of a THEME lock being ignored, most than one user may start to edit the Master shapefile at the same time. This could lead to major corruption of the Master shapefile.

This is also an extremely difficult problem to rectify. The administrator would have to take extreme care in deciding which shapes from each Clone shapefile need to be posted to the Master. This is accomplished by locking each feature manually and performing a Post operation. Once the Master has been restored to the proper state, delete the Clone shapefile from the workspace of each user. This will force the Master shapefile to be recopied from the network server to the workspace.

### **5.1.3. Improper Master Shapefile Names**

The names given to the shapefiles themselves should be descriptive and must be unique throughout the application. Improperly named shapefiles can lead to trouble.

#### **5.1.3.1. Avoid Powerpack Generated Shapefile Names**

It is important to pay attention to the names given to the Master shapefile. When a shapefile is created by Powerpack it will be given a name beginning with ‘U’ followed by a number: ‘U200.shp’. Recall that when the Master shapefile is backed up it is renamed with a number appended to the name of the shapefile.

Consider an instance where another shapefile created by Powerpack exists with the name ‘U2001.Shp’. When changes are Posted to the Master shapefile named ‘U200.Shp’, it will be backed up as ‘U2001.Shp’, overwriting the existing data source for the Master shapefile of the other theme.

(ie. ‘U200.SHP’ -> ‘U2001.SHP’)

Obviously, this will result in confusion and data loss. This situation can be avoided by giving meaningful names to the shapefile data sources of Navigator themes that are to be multi user enabled.

---

### 5.1.3.2. Multi User Shapefiles Must Have Unique Names

The shapefile name of each multi user enabled theme must be unique application-wide. Consider the following example:

- On the server, there exists 2 separate directories that store information pertaining to different levels of geography...

*N:/GIS/Shapefiles/Provincial/*

*N:/GIS/Shapefiles/Municipal/*

- Within each level of geography there will be a shapefile to store information pertaining to roads...

*N:/GIS/Shapefiles/Provincial/Roads.shp*

*N:/GIS/Shapefiles/Municipal/Roads.shp*

- If both of these shapefiles were loaded into Navigator and multi user enabled, it would mean that they would both be copied into the user's workspace directory.

*C:/GIS\_TEMP/Roads.shp*

- Obviously, this would be impossible because both shapefiles have the same name.

### 5.1.4. Master Shapefile Not a Unique Theme Data Source

The shapefile defined as the Master shapefile for any particular multi user enabled theme may not be used as a data source for any other Navigator themes. Recall that if more than one user is viewing the same shapefile and one of the users attempts to perform an edit, errors will occur. Defining a new Navigator theme on an existing multi user enabled Master shapefile will inevitably lead to shapefile corruption.

Should additional Navigator themes sharing an existing multi user enabled Master shapefile be required, use the Clone shapefile instead. This will ensure that access to the Master shapefile remains in the control of the multi user functionality.

When defining additional Navigator themes using existing Clone shapefiles, be mindful of the fact that ALL users must be able to access a theme by the same name using the same data path. This can be a problem if the path to the workspace differs between users.

For example:

- User 'aaa' has their workspace defined as 'C:\GIS\_TEMP'.
- User 'aaa' defines a new Navigator theme using a shapefile found in the workspace. (i.e., 'C:\GIS\_TEMP\POLYGONS.shp')
- User 'bbb' has their workspace defined as 'C:\GIS\GIS\_TEMP'.
- When user 'bbb' attempts to load the new Navigator theme defined by user 'aaa', a shapefile of that name will not be found.

---

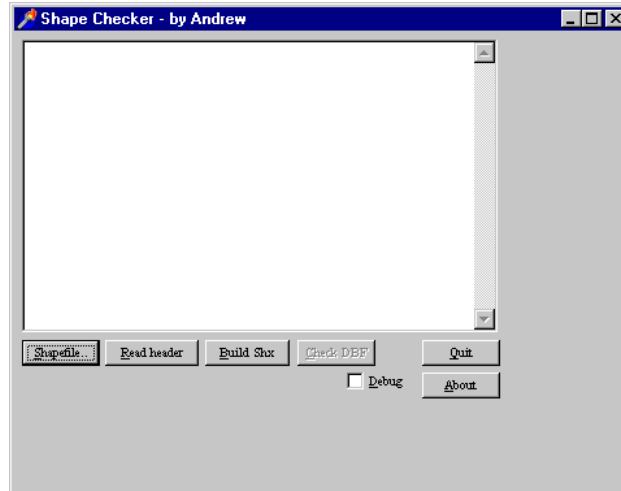
## 5.2. Shapefile Corruption

Shapefile corruption is the very disaster that multi user enabled shapefiles were created to overcome. There are many ways in which a shapefile can become corrupt. The most common scenario would be two users accessing the Master shapefile directly and performing edits at the same time. Others include inaccessibility to the Master shapefile, computer crashes occurring in the midst of a Post or Refresh operation and manually editing the feature attribute table (\*.dbf) without the shapes in the view.

### 5.2.1. Shapefile Repair Utility

The 'Shape Checker' program is a small application that will enable corrupt shapefiles to be restored to a workable state. It is available without charge on the internet. If you are unable to find this utility on the internet it can be obtained from Linnet, although there is no guarantee that it will be the latest version.

- To start the 'Shape Checker' program double click on the 'ShapeChk.exe' file. When it first starts, the following window will appear:



- Load a shapefile by clicking on the 'Shapefile' button.
- The program will then prompt instructions. The first instruction is generally 'Build SHX to start process'.
- Continue following the instructions that appear in the TextBox of the ShapeChk application.
- The repaired shapefile will likely not be recovered to such a state that it can be immediately used in a Powerpack application. It does, however, allow a user to be able to add the shapefile to a View in order to examine it's contents.
- Generally, a shapefile is considered corrupt because the number of shapes does not match the number of records. The 'Shape Checker' program simply adds blank records to shapes that have lost their attribute record.

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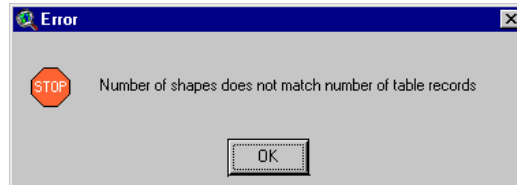
## 5.2.2. Signs of Corruption

Generally, when either a Clone or a Master shapefile becomes corrupted it will be discovered during a Post or Refresh operation (in Powerpack version post Sept 1999). Both Post and Refresh operations are designed to detect corruption and report it to the user immediately after it has been identified. When a corruption is encountered the system will halt the current process to ensure that the corruption does not spread.

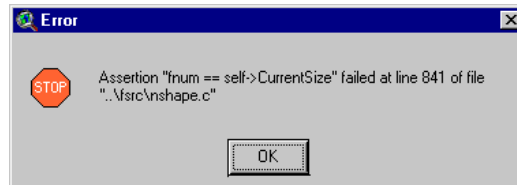
Whenever a shapefile becomes corrupt, it is important that all users stop using the application immediately. If the corrupt shapefile is a Master, all users must stop using the application until the problem can be fixed. Using the application may cause further damage, not to mention make the current problem increasingly difficult to fix.

Normally, theme corruption can be identified by an error message followed by another message informing the user which file has been corrupted.

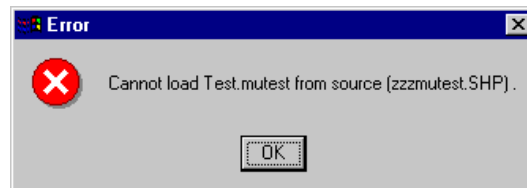
When the Database portion of a shapefile is out of synch with the shape portion of a shapefile, the following message is likely to occur:



Another error message that indicates a corrupt shape file is...



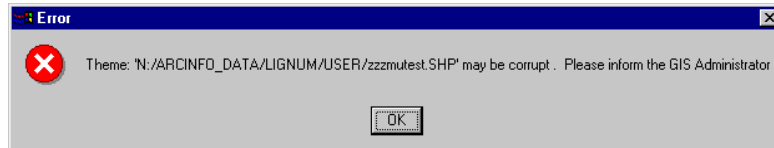
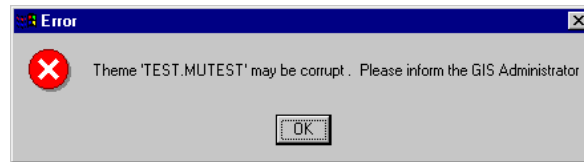
When attempting to load a corrupt shapefile through Navigator, the following message may appear:



This message can also occur if the Master shapefile has been moved from its originally configured location, or if the user does not have access to the directory in which the Master shapefile is stored.

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Messages, such as the following, warn the user of theme corruption. These messages may appear after the initial Error message is issued. The purpose of the following messages is to inform the user as to exactly which shapefile is corrupt.




### 5.2.3. Determining Which File is Corrupt

If the Error messages displayed are not clear enough to determine exactly which shapefile has become corrupt, it may be necessary to do some detective work. This involves attempting to load the Master and the Clone shapefiles individually using the 'Add Theme' button in Long Menus:



Make sure that no other users are using the system while attempting to view the Master shapefile.

To verify that the shapefile is not corrupt, make sure to test that the shapes actually display in the view (turn the theme on) and that you can open the theme's attribute table . If the shapefile loads, displays the shapes and attribute table successfully, it is not corrupt. Make sure to remove the Master shapefile and attribute table from the project.

### 5.2.4. Fixing a Corrupt Clone

If it has been discovered that a Clone version of the shapefile has become corrupt make sure that all users stop using the GIS immediately. This will ensure that the information in the Master shapefile does not change while investigating the corruption.

Check the Master shapefile to make sure that it has not become corrupt. Also check the Clone shapefiles existing in each user's workspace to make sure that they have not become corrupt as well. Powerpack versions after September, 1999 check for Clone shapefile corruption specifically, and will stop execution of the Post and Refresh operations as soon as a corrupt file is found.

It is a good idea to figure out if any feature 'Edit', 'Delete' or 'Add' operations were lost. The 'Edit History' dialog may not be of much use in a case such as this because Post transactions are only recorded once they have been completed (ie. Written to the Master shapefile).

The best way to verify if any edits have been lost is to check to see if the user had made any changes to the Clone shapefile that were not posted to the Master shapefile before the

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corruption occurred. The quick and easy way to do this is to check for any feature locks for the corrupt theme that have been placed by the current user.

- From the Admin Menu, select 'Clear Outstanding Transactions...'. If the theme containing the corrupt Clone shapefile has any outstanding transactions by the current user, it means that the user had locked one or more features and did not Post them. If this is the case, repairing Clone shapefile may be the only way to restore the edits made. *Do not remove any feature locks.*
- Advanced users of the system may wish to consult the MU\_LOCK table directly in order to discover exactly which features have been locked.
- Attempt to repair the corrupt shapefile using the 'ShapeChk.exe' utility program (sec 5.2.1)
- Once the shapefile has been 'repaired' load it into the view using the 'Load Themes' button. Open the attribute table associated with the theme. Any features that were missing an attribute table record, causing the shapefile to be 'corrupt', will now contain a record of 'blank' values. Make note of these features by selecting them.
- Now, load the Master shapefile into the view and compare each of the features selected in the Clone shapefile with those of the Master.
  - If a feature does not exist in the Master shapefile, but does exist in the Clone shapefile, it is possible that the feature was added by the user and not Posted to the Master.
  - If a feature appears different in the Master shapefile than in the Clone shapefile, it is possible that the feature was edited and not yet Posted to the Master. Consult the 'Edit History' of that particular feature and see if it was recently edited by another user. It is possible that an edit was made by another user and the current user had not yet refreshed their Clone shapefile.
- If it has been determined that edits were made to the Clone shapefile and not Posted to the Master shapefile, it may be necessary to perform these edits again once the Clone shapefile has been replaced. Before the Clone shapefile is replaced, rename the current restored Clone shapefile to another name. In Long Menus use the 'Convert to Shapefile...' function to export the shapefile to a new name. Don't forget to make the theme to be exported 'active' and unselect any selected features.

When a Clone becomes corrupt it will likely be necessary to replace the corrupt Clone with a new copy. This can be achieved by deleting the shapefile from the user's workspace using the NT Explorer. The next time the theme is loaded through Navigator, the Master shapefile will be copied.

When deleting a shapefile from a user's workspace, make certain that all of the component files are deleted. For instance if deleting a shapefile called 'OPENING.SHP', all of the following files must be deleted:

- Opening.shp
- Opening.shx
- Opening.dbf
- Opening.sbn (may or may not exist)
- Opening.sbx (may or may not exist)

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It may be necessary to close Arcview before deleting these files, or you may get a 'File Currently In Use' error from the NT system.

If it was discovered that some features were locked prior to the corruption, these features can now be restored individually. To do this open a Designer session and add the theme that was repaired using the ShapeChk.exe program.

- Make the 'foreign theme' (the theme repaired using the ShapeChk.exe program) the 'Copy Theme'.
- Using the 'Select to Edit' tool, select the feature to be 'Replaced'. This will load the Shape Editing environment.
- Using the 'Copy and Paste' tool, copy the correct shape from the 'foreign theme' to the 'Editable' theme.
- Use the 'Replace' button to replace the outdated shape with the updated shape.

Be mindful of the fact that when a new feature is first created, the application creates an accompanying reference in the database. If the feature is never successfully Posted to the Master shapefile, the database records maintained by the application will become 'orphaned'.

### **5.2.5. Fixing a Corrupt Master**

If it has been determined that the Master shapefile has become corrupt, it is important to ensure that no data is lost due to the recovery process. Make certain that all users stop using the GIS application immediately.

Check the Clone shapefiles existing in each user's workspace to make sure that they have not become corrupt as well. Powerpack versions after September, 1999 check for Clone shapefile corruption specifically, and will stop execution of the Post and Refresh operations as soon as a corrupt file is found.

There are a couple of tools available to the administrator to ensure that the Master is recovered successfully, without data loss.

Recall that each time a Post is made to the Master shapefile, a backup is made. When a Master shapefile is identified as being 'corrupt', all Post and Refresh operations will not be allowed to take place. This ensures that a corrupt file will not be backed up.

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The first step would be to find the last good back up made. To do this check the 'Modified' property of the shapefile back ups. In the example below, 'P\_OPEN1.SHP' appears to be the most current back up available.

Name:	Modified:
P_OPEN.SHP	9/22/99 9:45 AM
P_OPEN.SHX	9/22/99 9:45 AM
P_OPEN.DBF	9/22/99 9:45 AM
P_OPEN1.SHP	9/22/99 9:33 AM
P_OPEN1.SHX	9/22/99 9:33 AM
P_OPEN1.DBF	9/22/99 9:33 AM
P_OPEN2.SHP	9/20/99 10:22 AM
P_OPEN2.SHX	9/20/99 10:22 AM
P_OPEN2.DBF	9/20/99 10:22 AM
P_OPEN3.SHP	9/20/99 2:34 PM
P_OPEN3.SHX	9/20/99 2:34 PM
P_OPEN3.DBF	9/20/99 2:34 PM

Ensure that 'P\_OPEN1.SHP' is not corrupt by attempting to load it into Arcview using the Load Theme button in Long Menus:



If the shapefile loads successfully, it is not corrupt. If all back ups are found to be corrupt, tape back up versions or Clone shapefiles must be used. To decide which Clone shapefile to use an advanced user may have to consult the MU\_MOD table to decide which Clone shapefile is the most up to date.

Once the latest good backup has been found, the next step is to determine if any data has been lost. By comparing values maintained in the 'Edit History' dialog to the dates that the Master shapefile backups were created, it can be determined if any Post operations have been issued to the Master shapefile since the last successful Post operation. It will also be possible to determine which user performed the last Post operations before the corruption.

Consider the following Example:

- While Posting the to the 'Planned Harvest.Opening' theme it was discovered that the Master Shapefile (P\_OPEN.SHP) has become corrupt.
- Tell all users to stop using the GIS immediately.

- From the Windows NT Explorer, the following information can be seen:

Name:	Modified:
P_OPEN.SHP	9/22/99 9:45 AM
P_OPEN.SHX	9/22/99 9:45 AM
P_OPEN.DBF	9/22/99 9:45 AM
P_OPEN1.SHP	9/22/99 9:33 AM
P_OPEN1.SHX	9/22/99 9:33 AM
P_OPEN1.DBF	9/22/99 9:33 AM
P_OPEN2.SHP	9/20/99 10:22 AM
P_OPEN2.SHX	9/20/99 10:22 AM
P_OPEN2.DBF	9/20/99 10:22 AM
P_OPEN3.SHP	9/20/99 2:34 PM
P_OPEN3.SHX	9/20/99 2:34 PM
P_OPEN3.DBF	9/20/99 2:34 PM

- By examining the 'Modified' property of each of the shapefiles, it is evident that 'P\_OPEN1.SHP' is the most recent back up for the 'Planned Harvest.Opening' theme. Notice that it was created on September 22<sup>nd</sup> at 9:33 am. Also notice that the 'P\_OPEN.SHP' was created 12 minutes later at 9:45 am.
- Using the 'Edit History' dialog, find any features that were Posted after 9:33 am September 22<sup>nd</sup>. Using the 'Viewing Options' setting of 'Summary', we can easily identify the Post transaction that took place 9:33am on September 22<sup>nd</sup>. Once the 'Edit History' dialog is open, set the 'User' to 'ALL USERS' and the theme to 'Planned Harvest.Opening'. Sort the information by 'Date' to see the most recent entries at the top of the list:

User	Theme Name	Date	Added	Deleted	Modified
Aaa	Planned Harvest.Opening	22-SEP-1999 09:51:28	1	1	1
Bbb	Planned Harvest.Opening	22-SEP-1999 09:36:12	1	1	1
Ccc	Planned Harvest.Opening	20-SEP-1999 14:50:36	4	1	0
Aaa	Planned Harvest.Opening	20-SEP-1999 10:24:22	0	0	2

- Each Post transaction will have made a back up of the Master shapefile. In this example, Powerpack is generating 3 back ups before the initial back up is overwritten. Notice that the date/time stamp of each Post transaction does not match the exact time of the back ups. For instance, for the transaction occurring on September 22<sup>nd</sup>, at 9:36am, there is a back up made at 9:33am. This is because the back up is made prior to the Post operation actually taking place. Plus, the timestamp used to record the date that the back up file was created is generated differently than the timestamp used to record the Post transaction. The back up file uses the date/time generated by the server, while the 'Edit History' uses the time from the DBMS.

- To discover exactly which features were involved in the last Post operation, set the 'Viewing Options' setting to 'Details'. Next set the 'User' to 'ALL USERS' and the theme to 'Planned Harvest.Opening'. Sort the information by 'Date'. The following information is displayed:

User	Theme Name	Date	Action	Record #
Aaa	Planned Harvest.Opening	22-SEP-1999 09:51:28	ADD	130182
Aaa	Planned Harvest.Opening	22-SEP-1999 09:51:28	MODIFY	130181
Aaa	Planned Harvest.Opening	22-SEP-1999 09:51:28	DELETE	130021
Bbb	Planned Harvest.Opening	22-SEP-1999 09:36:12	ADD	130181
Bbb	Planned Harvest.Opening	22-SEP-1999 09:36:12	MODIFY	130073
Bbb	Planned Harvest.Opening	22-SEP-1999 09:36:12	DELETE	130100
Ccc	Planned Harvest.Opening	20-SEP-1999 14:50:36	ADD	130180
Ccc	Planned Harvest.Opening	20-SEP-1999 14:50:36	ADD	130179
Ccc	Planned Harvest.Opening	20-SEP-1999 14:50:36	ADD	130178
Ccc	Planned Harvest.Opening	20-SEP-1999 14:50:36	ADD	130177
Ccc	Planned Harvest.Opening	20-SEP-1999 14:50:36	DELETE	122998
Aaa	Planned Harvest.Opening	20-SEP-1999 10:24:22	MODIFY	130021
Aaa	Planned Harvest.Opening	20-SEP-1999 10:24:22	MODIFY	130027

- Now it is evident that user with user\_id 'Aaa' performed the last Post operation. This means that the Clone shapefile in the workspace belonging to user 'Aaa' will contain the most recent edits. This does not necessarily mean that the Clone shapefile existing in user 'Aaa's' workspace can simply be copied to the server and made into the new Master shapefile. User 'Aaa' may not have been using the most recent copy prior to making edits.
- At this point we know that the back up shapefile 'P\_OPEN1.SHP' is the most recent back up and therefore contains all of the latest edits minus the last Post transaction made by user 'Aaa'. We also know which features were involved in the last Post transaction by user 'Aaa':
  - Feature 130182 was 'Added'
  - Feature 130181 was 'Modified'
  - Feature 130021 was 'Deleted'
- We now have enough information to restore the Master shapefile. Using the Windows NT Explorer, rename the files that make up the Master shapefile. For instance:

```
P_OPEN.SHP -> P_OPEN_BAK.SHP
P_OPEN.DBF -> P_OPEN_BAK.DBF
P_OPEN.SHX -> P_OPEN_BAK.SHX
```

- Using the Windows NT Explorer, replace the Master shapefile with the most recent back up copy:

```
P_OPEN1.SHP -> P_OPEN.SHP
P_OPEN1.DBF -> P_OPEN.DBF
P_OPEN1.SHX -> P_OPEN.SHX
```

- Add the Master shapefile to the Arcview project and delete feature with Record\_Num = 130021.
- Remove the Master shapefile and accompanying attribute table from the project.

- 
- From user 'Aaa's' computer, log into the GIS as user 'Aaa'. Load the 'Planned Harvest.Opening' theme into the view using Navigator.
  - Open the attribute table and make the 'Record\_Num' column visible. Find 'Record\_Num '130182' and assign it to a value of '0'.
    - It is important to ensure that features 'ADDED' are not lost. When a feature is first created, the application creates an association between the feature and the business side of the application. The business side of the application will maintain database records associated with the feature. The link between each feature and the database records is made using the 'key field' value, not the Record\_Num value (see 4.7.1). If the feature is lost it can create 'orphaned' records in the database.
    - EDIT ONLY THE ATTRIBUTE TABLE and do not lock the feature when making this change. To do this, make the attribute table the active document and then select 'Start Editing' from the menus.
    - Because this feature only exists in the Clone shapefile and not the Master shapefile, Powerpack will interpret this to mean that the feature has been deleted by another user and proceed with *deleting* it from the Clone shapefile as well. However, if we change the Record\_Num value to '0', Powerpack will think that it is a new feature. In which case, the feature will be assigned a new Record\_Num value and added it to the Master shapefile. This will maintain the link between the database and the feature.
  - In the 'Planned Harvest.Opening' theme, find feature with Record\_Num = '130081'.
  - If the Admin Menu is present in the user's application, lock feature with Record\_Num = '130081' and initiate a Post operation.
  - If the Admin Menu is not present you will have to force it to display by double clicking on a blank portion of the tool bar to display the 'Customize:' dialog. From here the 'Admin' menu may be toggled to 'visible'. This should only be done by an administrator and must be toggled back to 'invisible' once complete.
  - Allow other users back onto the GIS system.

Not all of this process described above may be necessary to completely restore a corrupt Master shapefile. For instance:

- If it can be determined that the backup is completely up to date, then simply replace the original with the backup using the Windows NT Explorer.
- If the Clone shapefile appears to be more up to date than the Master shapefile back up, simply replace the Master shapefile with the Clone version using the Windows NT Explorer. This would involve comparing values in the MU\_MOD table in order to verify that the Clone shapefile is completely up to date.

As with repairing a corrupt Clone shapefile, the 'ShapeChk.exe' program can be used to repair a Master shapefile. The repaired shapefile will not replace the Master shapefile, but it can be used to deduce what information is missing. (sec 5.2.1)

---

## 5.3. Other Anomalies and Solutions

There are situations that arise that can cause problems with the multi user shapefile functionality. Where possible, these problems are identified and a solution is sought. Some of these problems can be avoided with improved awareness of how the system works, while others are simply limitations.

### 5.3.1. Purging Too Many Records: ‘Phantom Features’

When a feature is locked for editing, a check is done through the ‘Edit History’ to make certain that the feature has not been edited or deleted by another user since the theme was last refreshed. If it has been determined that the feature no longer exists in the Master shapefile, the feature will not be locked.

Records in the ‘Edit History’ can be ‘Purged’ in order to keep this search for edited and/or deleted features short. If a ‘Purge’ operation clears out reference to features that have not yet been refreshed by all of the users, the result could lead to previously deleted features reappearing and previous feature edits being lost in the Master.

Be careful not to ‘Purge’ references to features that have not been refreshed by all users. In general, it is recommended that those records older than 30 days be purged.

### 5.3.2. Item in Clone Won’t Refresh

On rare occasion, a feature in a user’s Clone shapefile will remain unchanged after a refresh operation. Should this ever occur in a system, begin by comparing the ‘Record\_num’ value of the item with that found in the Master shapefile. These features should share the same ‘Record\_num’ value.

To remedy this situation, simply have another user lock and re-Post this feature from their Clone shapefile. The feature will be refreshed the next time the theme is refreshed.

### 5.3.3. ‘Novell’ Ideas

Novell networks have been found to cause corruption of shapefiles during the Post process. This could be due to the amount of time it takes to start and stop editing a shapefile. It may also be due to access to the Master shapefiles via the network.

### 5.3.4. No Read/Write Access to Master

As would be expected, it is imperative that each user have ‘Read/Write’ access to the Master shapefiles. Without ‘Read/Write’ access, posting features will be impossible.

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### 5.3.5. Sequence Out of Sequence

Each feature in a multi user enabled shapefile is assigned a unique Record\_Num value. Powerpack derives each new value using the next value in a 'Sequence' found in the 'NEXT\_SEQ' table.

For Example:

- Theme with theme\_id = 1879, the NEXT\_SEQ' table will contain a Keyword value = 'THEME\_REC\_NUM:1879'.
- The VALUE column of this record will contain the next value to be used when a new feature is added to theme with theme\_id = 1879.
- If the VALUE column contains a value = 130188, then when a feature is added the new feature is assigned a Record\_Num = 130188 and the value in the NEXT\_SEQ table increments by 1.

The NEXT\_SEQ table and all of the values contained within it are maintained completely by Powerpack. There may be instances where these values have been configured independently by an Administrator. If the VALUE of the next sequence is lower than the highest Record\_Num in the multi user enabled shapefile, duplicate Record\_Num values will appear causing major problems in the Post and Refresh operations.

### 5.3.6. Shipping Shapefiles without the DBMS

Each feature in a Powerpack based application will likely contain an association to records maintained in a DBMS. When a feature is deleted using Designer, the associated records in the DBMS are also deleted. The shapefile feature and the DBMS association are both parts of the same feature.

This association means that shapefiles from one GIS system cannot simply be copied and placed into another system existing at a different site. When you copy the shapefile, only half of the required data is being copied: the DBMS associated records remain at the original site.

### 5.3.7. Clone Shapefiles Belong to One User Only

The Clone shapefiles that exist in a user's workspace are to be used by that user only. They cannot be copied to another user's workspace. Transferring Clone shapefiles between workspace directories will create a situation not unlike the 'Musical Chairs' syndrome (sec 5.1.1)

### 5.3.8. Master Accidentally Brought into Project

It is imperative that users never bring the Master shapefile into their project. This can lead to the corruption of the Master shapefile. This situation can occur accidentally in situations where the GIS system may have lost track of a certain shapefile and prompts the user for its location. The user then locates the Master shapefile and defines it as the missing file. Users should be educated to avoid this situation.

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### **5.3.9. Workspace on Local Drive, Not Network Drive**

In configurations with slow networks or slow servers, it is best if the user's workspace (GIS\_WKSP) is defined on the local machine. Clone shapefiles are accessed much more frequently than Master shapefiles and therefore, access to them should be made as fast as possible. If placed onto a slow network access to them may begin to impede the performance of the GIS as a whole.

### **5.3.10. Theme Filters**

There are 3 ways to define a Filter for a theme. Of these 3 methods one will cause problems, another may cause problems in older versions of Powerpack and one is completely safe.

The proper way to define a Theme Filter is to use the Filter Manager. Filters defined using the Filter Manager will not cause any known problems regarding the multi user shapefile functionality.

Filters may also be defined using the 'Definition' property selection in the 'Properties' tab of the Theme editing window in Navigator Admin. This method is only safe in versions of Navigator released after July 9, 1999 (Navigator version 2.1.14 and on).

Defining Theme Filters using the 'Theme Properties' dialog available through Long Menus will cause data loss in multi user shapefiles. Filters placed by this method are not recognized by the Post and Refresh operations and as such, invisible features are thought of as being 'Deleted'.

### **5.3.11. Clearing out the Workspace (GIS\_WKSP)**

The shapefiles existing in a user's workspace should not be deleted. It is important to educate users not to delete any shapefiles that exist in this directory. Unposted changes may be lost as a result.

### **5.3.12. Multi User Themes in Multiple Views**

The multi user functionality assumes that the user has only one View per project. It is advised not to use more than one view per project.

### **5.3.13. Copy and Paste Multi User Themes**

The 'Copy' & 'Paste' Theme functions should not be used on Navigator themes, and especially not those which are multi user enabled. Navigator will not allow the multiple copies of the same multi user theme to exist in a project. By performing 'Copy Theme' and 'Paste Theme' functions, this rule is violated. The result may be a corrupt Project, Clone shapefile or both.

Arcview allows a user to 'Copy and Paste' themes from one view into another. Since the multi user functionality assumes that the user has only one View within which to work, 'Copying' a theme from one View into another is therefore, not advised.

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### 5.3.14. Frequent Corruption

If shapefiles are becoming corrupt relatively frequently, there may be something wrong with the way in which the application has been configured. In order to fix the problem we have to first isolate where the problem is occurring. Here are some steps to take should you find corrupt shapefiles on a regular basis:

***Increase the ‘Delay before Posting’ value in the ‘Powerpack System Settings’.***

- If Master shapefiles are becoming corrupt on a regular basis then perhaps the speed network has something to do with it. It could be that saves made Master shapefiles after each Post operation are taking too long. Increasing the ‘Delay before Posting’ setting may allow for enough time to save the Master shapefile before another user starts editing.

***Increase the number of back ups in order to increase the chance of making a full recovery.***

- Each time a Post operation is run, a back up is made of the Master shapefile. The number of separate back up shapefiles maintained is defined in the ‘Number of Master Shapefile Backups’ parameter, found in the ‘Powerpack System Settings’ dialog. By maintaining a higher number of back ups (3-5), the chances of making a full recovery after corruption, will improve.

***Start logging activities; preferably with screen captures.***

- By logging activities on the GIS it may be possible to recognize patterns and eventually discover the source of the problem. Attempting to resolve any system configuration issues is almost impossible if problems are defined solely by stating that the ‘Master shapefile is frequently corrupt’. What is preferred is a description of what took place before the corruption occurred. For instance:

“Entered Designer to Edit a ‘Planned Harvest.Opening’ polygon. Selected a feature to Edit in Designer Edit mode. Digitized a new polygon then used the Replace Feature function to Replace the Feature with the newly digitized graphic. Exited Designer. ‘Planned Harvest.Opening’ theme began to Post when the following error message appeared...”

- Where possible Screen Captures should accompany the description. This will help in determining the state of the GIS system when the error occurred.