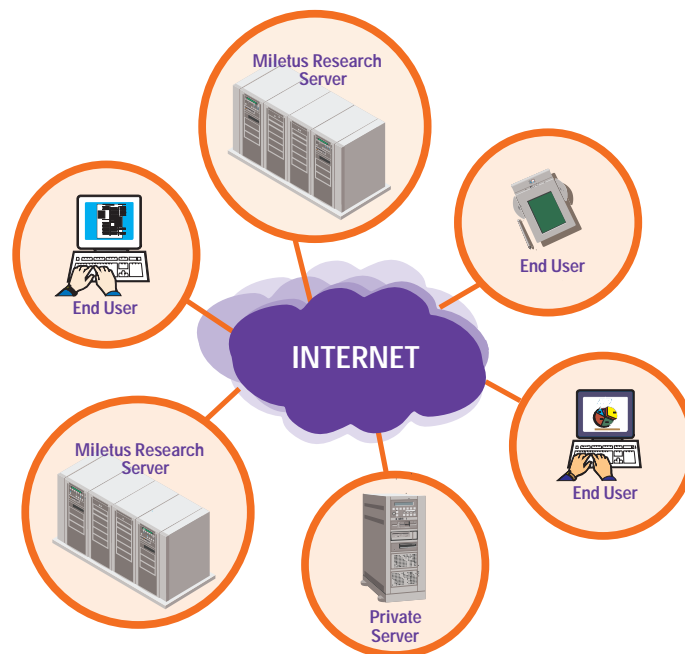


Net-Archive

User Manual

1.0



Win95/NT, Macintosh, and Unix Platforms

Internet Backup and Archive Sharing System

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Revision 1
February 1998

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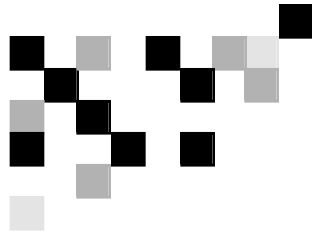
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WELCOME

FROM THE PRESIDENT

Thank you for purchasing Net-Archive, and welcome to a growing community of people who rely on Miletus Research for providing safe, secure, and affordable means for archiving information.

Net-Archive™ is the primary technology that implements the DISTributed Archive for Nomadic Computing Environments (DISTANCE) system, which enables global access to information using secure “client-side” encryption that ensures that only *you* (and others who you allow) see your information.

The DISTANCE system originated in the Computer Science Department at Rutgers University where it has undergone extensive development on a variety of platforms. Your Net-Archive software is a commercial release of the DISTANCE system that has been recoded and optimized by Miletus Research to get the most out of your Internet connection.

We at Miletus Research appreciate your support of our technology. We encourage you to explore your new capabilities and enjoy the full benefits of your Net-Archive software.

As the President of Miletus Research, I welcome your comments. Please feel free to contact me directly.

Sincerely,

Miles Murdocca, Ph.D.
Miletus Research
murdocca@miletus.com
<http://www.miletus.com>

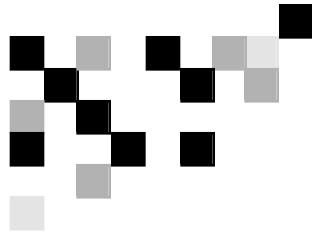
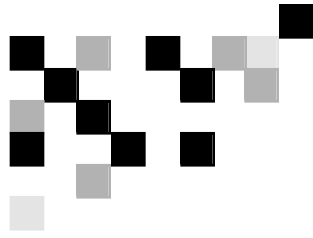


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GETTING STARTED

1

1.1 WHAT IS NET-ARCHIVE?

Net-Archive Client backs up your computer files to a Net-Archive Server site over a network, such as a dialup connection to the Internet. Net-Archive consists of a *client module*, which runs on your computer, and a *server module* which runs on an archive site, which may be your own site or the Miletus Research Server Constellation.

Without Net-Archive, your computer may seem safe and secure because it works just fine each time you use it. But that won't last forever, possibly a few years at best, or a few more moments at worst! Hard magnetic disks commonly fail, computers get damaged or stolen, and valuable files get inadvertently deleted. Even if you are one of the lucky few who never suffers a major disk failure, information stored on your computer is still vulnerable to damage, theft, inadvertent deletion, or simply being unavailable when you and your computer are in different places.

"I make backups of my hard disks every day. Isn't that good enough?"

Making regularly scheduled backups of your hard disks is a good idea. But maintaining backups in the same location as your computer is not a good idea, because the mishap that happens to your computer can happen to your backups too.

Net-Archive addresses these problems by backing up your most valuable files to a networked repository using a safe, secure, reliable, and inexpensive archiving mechanism.

Net-Archive decomposes your files into encrypted segments that are uploaded to an archive site using the idle time on your network connection. The idle time on the uplink connection from an end-

user to the Internet is typically over 90% (see Appendix A for an explanation), so Net-Archive does not noticeably load your network connection. Your network connection normally saturates on the downstream link to your computer – not on the upstream link to the Internet.

Encryption is applied *before* the segments leave your machine, thus protecting your information against eavesdropping along the path from your computer to the archive site. All you need is an Internet connection: Net-Archive does the rest.

1.1.1 An Overview of Net-Archive Client-Server Interaction

An overview of Net-Archive client-server interaction is shown in Figure 1-1. End-user systems (the clients) communicate with Net-Archive servers via the Internet (or equiva-

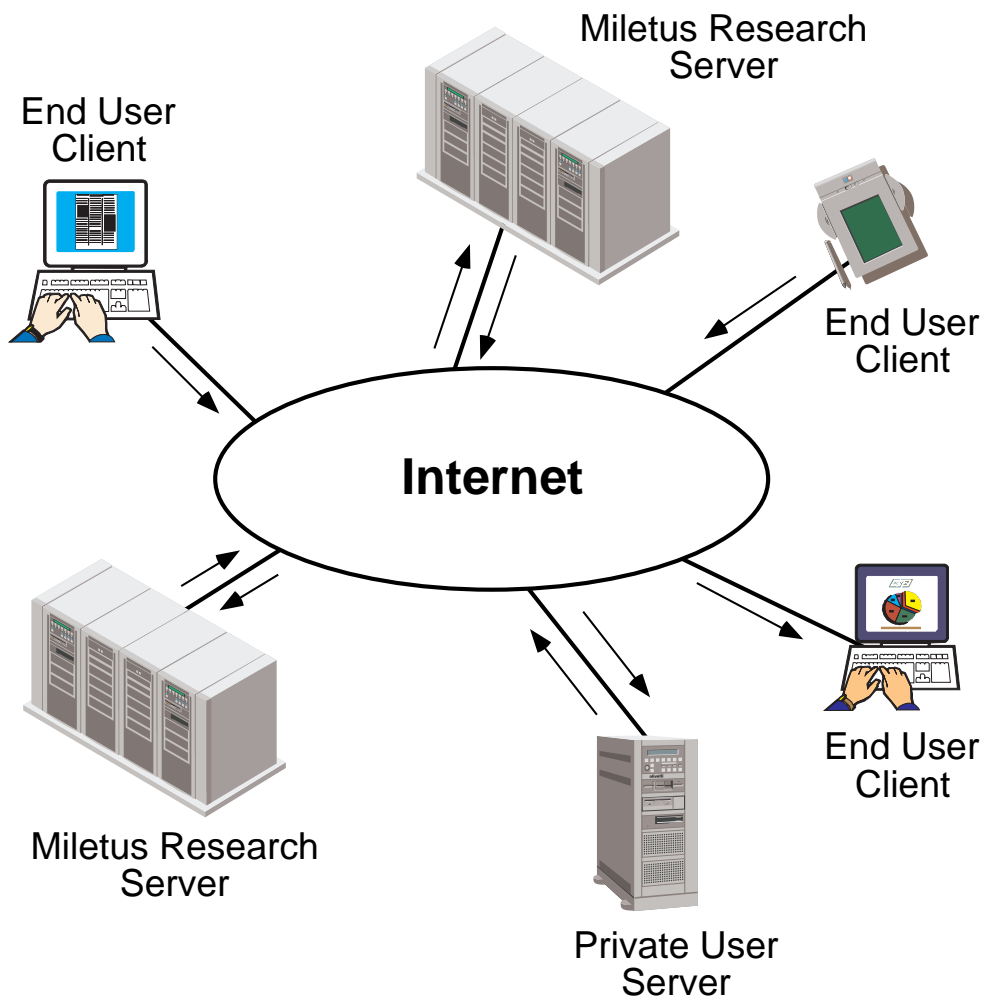


Figure 1-1: An overview of Net-Archive client-server interaction.

lently, a private network.)

From the user's perspective, backups of local files automatically take place in a safe, unobtrusive manner using the available uplink bandwidth ("bandwidth" is a measure of the amount of information that can be transferred through a medium over a given period of time.) Although your computer may only be connected to a network at intermittent times (which is when your files are uploaded via Net-Archive), the archive at the server site is accessible at anytime, from anywhere on the Internet. Your electronic information enjoys high availability, yet is accessible only to those users who you allow.

You are already paying for your network connection – and it doesn't cost you anything more to use Net-Archive. In a study carried out by Dr. Miles Murdocca at Rutgers University (see Appendix A), traffic monitoring of over 400 dialup modem lines shows that less than 9% of dialup traffic flows from the end-user to the Internet, leaving 91% of the end-user's upstream capability underutilized.

That means that a 28.8K modem only gets used as if it is a 2.6K modem in the upstream direction from your computer to the Internet. You are still paying the full price for that upstream bandwidth even though you are not using it. Your Net-Archive software fills that unused bandwidth with encrypted copies of your files, which are uploaded to your own server or to the Miletus Research Server Constellation. The result is that your files are inexpensively transmitted to a safe location, where they are always available to you and others who you allow to see your files.

1.2 WHAT'S IN THE BOX?

Your package contains the following items (If you obtained your software via our Web site at <http://www.miletus.com> then you can skip this section):

- A CD-ROM that contains all of the software and documentation;
- This user manual;
- Product registration card;
- If you purchased Net-Archive Server, a list of Net-Archive Client product identification codes that you can distribute to your user community.

Please check to make sure that everything is there.

A product identification code and a "server port" number (for Net-Archive Client only) are imprinted on both halves of the product registration card. Please fill out the product registration card and return it right away so that we can better serve you with free technical support, and so that we will know where to send you free software updates (your first two updates are free).

If you do not find any of these items, or have trouble using the media, please contact us and we will rush a replacement to you. All of these materials can be downloaded from our Web site <http://www.miletus.com>, or via anonymous ftp from [miletus.com](ftp://miletus.com) in directory `pub`.

1.3 SETTING UP THE CLIENT MODULE

The Net-Archive Client application is supported on three platforms: Macintosh, Windows 95/NT, and Solaris/SunOS Unix. You may install Net-Archive Client on as many machines as you like (the License Agreement allows you to do that.)

1.3.1 *Setting up the Windows 95/NT Client Module*

The Windows 95/NT client module is contained in a self-extracting archive named `nasetup.exe`. Insert the CD-ROM into your CD-ROM drive and double-click on the file named `nasetup.exe`. A dialog box will be displayed that guides you through the installation process.

1.3.2 *Setting up the Macintosh Client Module*

Depending on your version of MacOS and what other applications are installed on your machine, you may need to install Apple's Macintosh Runtime for Java MRJ 2.0. The safest installation approach is to install MRJ 2.0 before running Net-Archive Client. Here is what to do: Insert the CD-ROM into your CD-ROM drive and double-click on the `Net-Archive Installer` icon. A dialog box will be displayed that guides you through the installation process. Simply click on "Install" when presented with the options for which packages that you want to install, and MRJ 2.0 will be installed along with Net-Archive Client.

1.3.3 *Setting up the UNIX Client Module*

The UNIX client module is contained in a single tar file. Insert the CD-ROM into your CD-ROM drive, open the `CLIENTS` directory, and open the `SOLARIS` or `SUNOS` directory as appropriate for your operating system. Unpack the `net-archive_client` tar file that matches your operating system by first copying the tar file to the target directory, and then using:

```
% tar -xvf net-archive_client.sunos5v1.0.tar
```

or:

```
% tar -xvf net-archive_client.solaris2v1.0.tar
```

You can delete the `.tar` file after unpacking the client.

1.4 TRY IT OUT

You can test your client module(s) by connecting to the Miletus Research Server Constellation after keying in the product identification code and the server port, as im-

printed on both halves of your product registration card, the first time that you use Net-Archive Client. If you purchased Net-Archive Server, then you can connect to the guest server in the Miletus Research Server Constellation using the default settings.

On a Macintosh or a PC, double-click on the Net-Archive icon:



On a Unix machine, from within an X window, type:

```
% net-archive
```

On a Unix machine, you may need to modify your PATH variable (in `.login` or `.profile` in your home directory) to include the directory where you installed `net-archive`, and then log out and log in again so that the PATH change takes effect (or re-export your PATH variable for Bourne shell or type “`source .login`” for C shell.)

When Net-Archive Client starts up, an initialization banner will appear, and a “Configuration Wizard” will be displayed that prompts you for your product identification code (you do not have to enter a product identification code, but if you do not, then you will be unable to use the stronger encryption feature) and your server port. After exiting the Configuration Wizard, the Net-Archive Main window will be displayed as shown in Figure 1-2. Select “Save Settings” from the File menu.

Before you connect to a Net-Archive Server site, you will need to connect to the Internet (or your local network) using whatever method you normally use. This much you need to do on your own, as Internet service is not included in the package. This step typically involves using a modem to connect to an Internet service provider. On a “hardwired” system, such as in an office environment, your system may already be connected, and there would be nothing for you to do in that case.

After your Internet connection is established, click on the large “Net-Archive” icon. If all goes well, then you will see a welcome message from the Miletus Research Server Constellation.

If you do not see a welcome message or do not see the startup screen:

- Are you connected to the Internet? Net-Archive uses the TCP/IP protocol suite, and requires a network connection such as with a dialup modem using SLIP or PPP.
- Are you behind a “firewall”? In a corporate environment, external network traffic may be limited to only the types allowed by your system administrators, which may



Figure 1-2: *The Net-Archive Main window.*

not include Net-Archive if you don't tell them to configure the firewall to pass this traffic. Your software will work fine *within* a firewall if you have a Net-Archive Server module running within the firewall: the connection to the Miletus Research Server Constellation just won't work.

- In the unlikely event that the default Miletus Research server machine is unavailable (possibly because an intervening Internet router goes down), then try connecting to another site. Select "Setup..." from the Window menu, which will bring up the Setup window. Then, click on the Get Time button. If all goes well, you will be connected to the National Institute of Standards (NIST) facility in Boulder, Colorado (USA) where you will see the current time. This indicates that your installation did in fact go OK.

If your default settings get inadvertently changed, then you can always use the following guest account settings **for testing purposes only** (do not store anything important on the Miletus Research Server Constellation using these guest account settings, because the guest account is periodically cleared, and also because it is a public area with no security other than the encryption you enable in Net-Archive Client.)

Username = guest
Server Site = miletus.com
Password = miletusguest
Server port = 7165

1.5 BACKING UP FILES TO THE SERVER

So you're all set up! If you have any unresolved difficulty during the installation and testing of Net-Archive Client, please refer to Section 4.1 "Look Here First (Frequently Asked Questions)" and try to get the problem resolved before continuing.

Let's back up a few files to the server, and then restore them from the server in the next section. Begin by clicking on the "Backup" button in the Main Window:



The Net-Archive window shown in Figure 1-3 will appear. The default files and directories (folders) that appear in the uppermost text area may differ from the figure depending on your platform.

Select a file or directory to back up by single-clicking on it in the uppermost text area and then clicking on the "Add to Backup List" button:



Double-clicking on a file will also add it to the backup list, while double-clicking on a directory will expand it, exposing the files and directories it contains (if any). If there are specific files that you do not want to back up that are contained in a directory that will be backed up, then add them to the exclude list by clicking on the "Add to Exclude List" button:



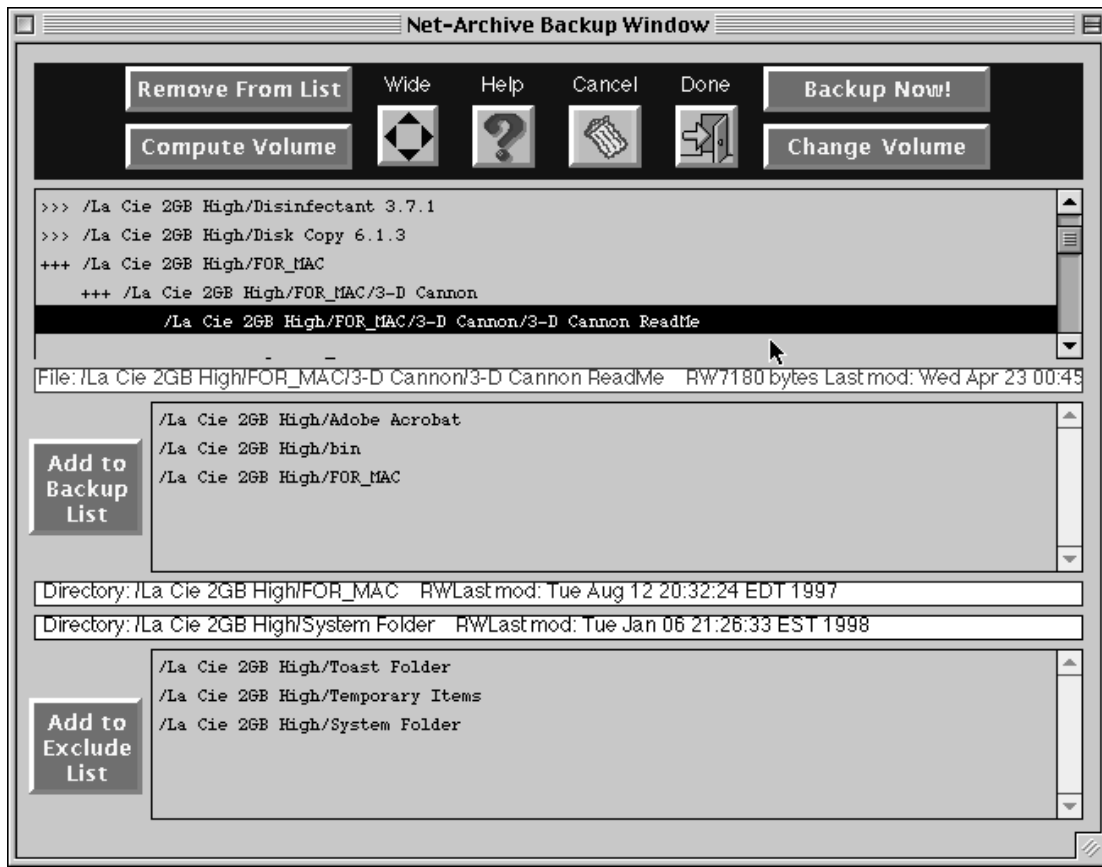


Figure 1-3: *The Net-Archive Backup window.*

When you are finished composing the backup and exclude lists, click on the “Compute Volume” button to check the volume of data to be backed up:



This step is not necessary, but it helps to have an idea of how long the backup will take based on the volume of data to be backed up. Computing the volume of data to be backed up is normally a fast operation, but this step can take a few minutes if there are several thousand files in the backup list. The backup volume will then be displayed in a popup dialog box.

You can dismiss the dialog box by clicking on the “Okay” button. Using a 28.8K modem, with other applications sharing the dialup connection, approximately 5 MB (5 megabytes = 5,242,880 bytes) can be backed up in 30 minutes. The average connect time on a dialup modem is approximately 30 minutes. With a 9% upstream utilization on a 28.8K modem (see Appendix A for how this measurement was obtained), the

average upload volume that can be accommodated without disturbing the user is 28,800 bits/sec \times 1/10 bytes/bit \times (60 sec \times 30 min) \times 91% = 4.7 MB (note that for transmission purposes, a byte is assumed to have 10 bits instead of the traditional 8 bits, because each byte is typically padded with a start bit and a stop bit.)

Next, click on the “Backup Now!” button and the backup process will begin, starting with the smallest files first.

You are free to use other applications while the backup process progresses. If you find that your other applications that are also competing for the dialup connection are responding too slowly, then disable the “Faster Transfers” checkbox in the Main window (either before or during the backup process.)

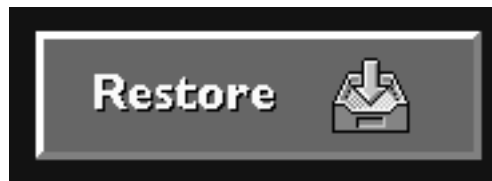
This will cause Net-Archive to back off on its use of the dialup line. Only about 1 MB can be backed up during 30 minutes on a 28.8K connection while the “Faster Transfers” checkbox is disabled, so be sure to re-enable it when you no longer need a rapid response in your other dialup applications.

When the backup process is completed, a completion message will be displayed.

Now let’s restore those same files to some other place on the local file system. Proceed to the next section.

1.6 RESTORING FILES FROM THE SERVER

To restore files from the server to the local file system, click on the “Restore” button in the Main window:



The Restore window will be displayed as shown in Figure 1-4. The list of files and directories to be restored will initially be empty.

Click on the “Get Archive Filenames” button:



The server will be contacted, and all of the files stored on the server will be displayed. You can restore all of the files displayed by simply clicking on the “Restore Now!”

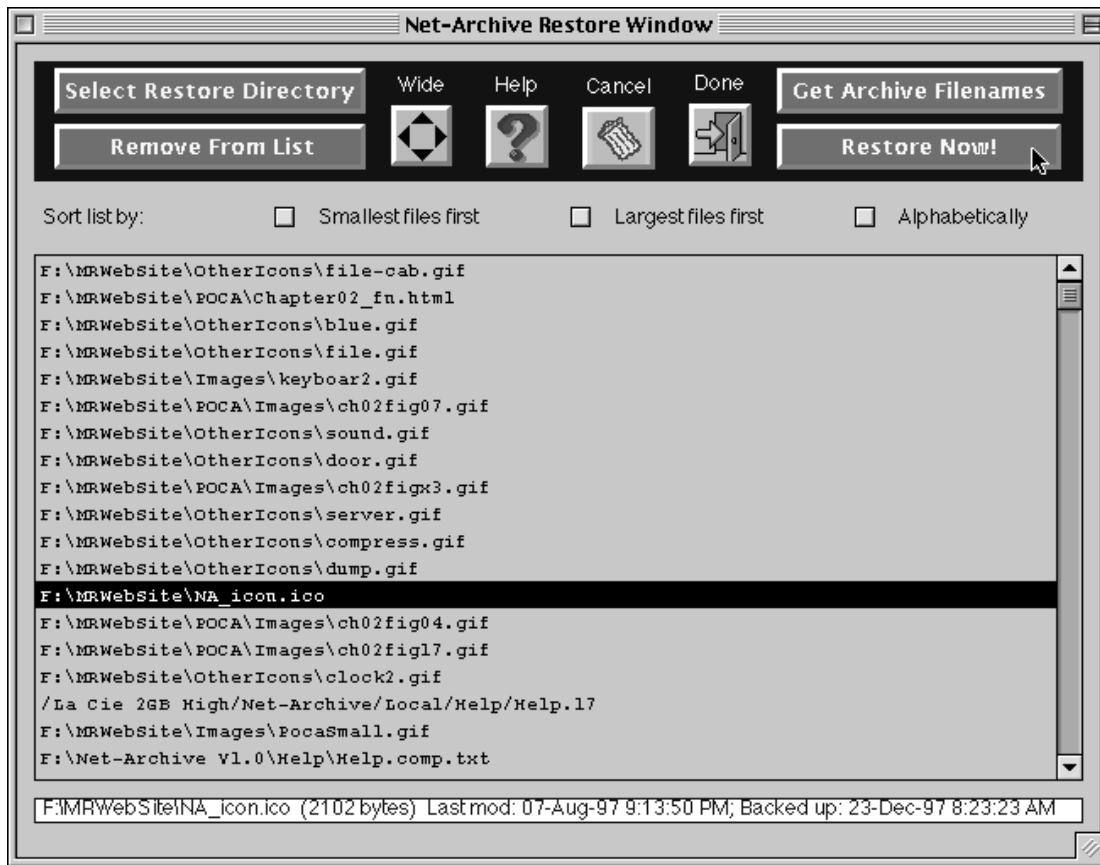


Figure 1-4: *The Net-Archive Restore window.*

button. If there are files you want to exclude from being restored, simply double-click on them before clicking on the “Restore Now!” button.

After the restore process completes, you can find the restored files in the directory (folder) named “RESTORE” in the same directory as the Net-Archive Client application, which is the default restore directory. You can change the default restore directory (before clicking “Restore Now!”) by clicking on the “Select Restore Directory” button.

1.7 SETTING UP THE SERVER MODULE

The server module is a single executable program that runs in a command line Unix environment. Insert the CD-ROM into your CD-ROM drive. Open the `SERVERS` directory, then open the directory that corresponds to your operating system, and then copy the tar file for your operating system to the target directory on your hard drive.

Unpack the tar file using:

```
% tar -xvf net-archive_server.solaris2v1.0.tar
```

(This example is for a Solaris 2 binary. Replace the tar filename with the name that corresponds to your operating system.)

A directory will be created with a name like “Net-Archive_serverV1.0”. You can remove the tar file at this point.

The first time time that you invoke `net-archive_server` you will be prompted for the product identification code, which you should enter as listed on your product registration card, or as you obtained separately if you downloaded the software from the Web.

The `net-archive_server` application can be invoked from the command line or via the `cron` daemon, using the command line options described in the `man` pages (see Section 3.3.) A typical command line invocation is shown below (see Chapter 3 for an explanation of the command line options):

```
% net-archive_server -B /vol1/archive -S 4000 -N >& errfile &
```

The base directory where the working archive is stored is specified with “`-B /vol1/archive`.” Change the argument for `-B` to the directory where your archive will reside. If the archive does not already exist in this directory then it will be created. The default base directory is `/tmp` (beware: `/tmp` is cleared on system reboots for some Unix systems, so you should specify a directory other than `/tmp` with the `-B` option.)

After verifying the Net-Archive Server product identification code, the server will exit immediately. You can then start the server as you normally would (but read Chapter 3 first so that you know how to prepare the command line options). You will not be prompted for the Net-Archive Server product identification code again.

1.8 WHERE TO GO FROM HERE

So you’re all set up! Here is where to go next:

1.8.1 Net-Archiving for End-Users

Whether you will be archiving on the Miletus Research Server Constellation or on another server constellation, you should customize your local configuration for the files and directories that you want to upload. Go to Chapter 2 next.

1.8.2 Administering Your Own Net-Archive Server

If you are administering your own Net-Archive server constellation, then you will need to customize your configuration for your user community. Go to Chapter 3 next.

1.8.3 Trouble Shooter

Sometimes unexpected things happen. Have a look at Chapter 4 for tips and answers to frequently asked questions.

1.8.4 Software Updates

Miletus Research is committed to maintaining Net-Archive by upgrading the Net-Archive software and making the upgrades available to you.

The most current releases of the client and server modules are always available from the Miletus Research Web site at:

`http://www.miletus.com`

and the Miletus Research anonymous ftp site at:

`ftp.miletus.com.`

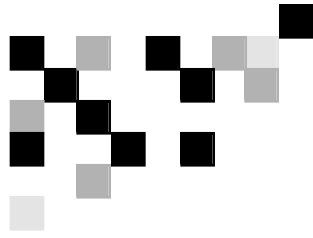
Your package includes two free software updates, which will be automatically mailed to you after you register your software by filling in and mailing or faxing your registration card to us.

1.8.5 Redistributing the Software

Can I give Net-Archive Client to someone else? Yes – the License Agreement (make sure you read it!) allows you to redistribute Net-Archive Client. You can even start your own Internet backup service using Net-Archive Server and redistributing the Net-Archive Client modules. See Chapter 4 under Frequently Asked Questions for more information.

1.8.6 What's New?

Net-Archive is continually being upgraded to keep pace with the changing needs of Net-Archive users. Have a look at Appendix B for what you can expect in forthcoming releases.



2

USING NET-ARCHIVE CLIENT

2.1 THE CLIENT MODULE

Net-Archive Client is invoked on a Windows 95/NT or a Macintosh computer by double-clicking on the Net-Archive icon. For these platforms, look for the icon shown below and double-click on it:



On a Unix platform, the Net-Archive client software is invoked from the command line, from inside of an X window:

```
% net-archive
```

2.1.1 The Main Window

After starting the program, a startup banner will be displayed, followed by a “Configuration Wizard” asking you to fill in your product identification code if you have not already done so (you can skip this field and fill it in at a later time.) The Net-Archive Main window shown in Figure 2-1 will be displayed (your screen may vary slightly, depending on your default configuration and the graphics characteristics of your system.)

The Net-Archive Main window has an Expert Interface format that can be invoked from the Expert menu. The Net-Archive Main window with the Expert Interface enabled is shown in Figure 2-2. The Easy Interface and the Expert Interface overlap in the various elements they contain, which are described collectively in this section.



Figure 2-1: *The Net-Archive Main window (Easy Interface).*

Status Window

```

**** New Session started Thu Jan 08 12:35:49 EST 1998 ****
Initialization went OK.
Connected to Miletus Research's test site where the local time is: Thu, 08 Jan 20 14:50:20 1998
SERVER: Client version is v1.0. Server version is v1.0
SERVER: *** User id: gpr1.2049 from site 207.116.196.95 connected to server.
SERVER: *** Welcome to the Miletus Research server control station.
SERVER: *** Guest account and password are 'guest' and 'abc'
SERVER: User id is authenticated OK.
Connection to server opened OK.
Looking for all files to archive...
C:\net-archive\bin\msdos\prj2\setup\libexec\bin\win32\get
C:\net-archive\bin\msdos\prj2\setup\libexec\bin\win32\get
C:\net-archive\bin\msdos\prj2\setup\libexec\bin\win32\get
C:\net-archive\bin\msdos\prj2\setup\libexec\bin\win32\get

```

The contents of the Status window are maintained in a history file named `NA_history` in the same directory as the Net-Archive Client application. Only the last 10,000 characters of this file are retained in the Status window, but the entire contents of the session can be viewed with an ordinary text editor in the `NA_history` file.



Figure 2-2: The Net-Archive Main window (Expert Interface).

Main Window Buttons

Net-Archive



Clicking on the Net-Archive button makes a connection to the Miletus Research Server Constellation. A welcome message is displayed, and the server then automatically disconnects. If you are not already connected to a network, then Net-

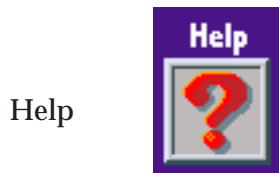
Archive will attempt to initiate the connection for you. This is a simple way to test that your network connection is up.

If you are behind a firewall that restricts TCP traffic to the outside, then you can replace the Miletus Research Server Constellation with a system inside of your firewall, even if it is not running the Net-Archive Server software, by making appropriate changes in the Setup window as described in Section 2.1.3.

The Net-Archive button can be clicked at any time, without disturbing operations in progress.



Clicking on the Setup button invokes the Net-Archive Setup window. See Section 2.1.3 for a description.



Clicking on the Help button invokes the Help window. See Section 2.1.2 for a description.



Clicking on the Wide button (arrows pointing outward) extends the Main window to the width of the user's screen, allowing text lines in the Status window to extend to the full width before wrapping around. The Wide button then changes to Thin (arrows pointing inward), which restores the Main window to its initial size when it is clicked.

Intermediate sized windows can be obtained by adjusting the window resize box (lower right corner on Macintosh and Windows machines, and the Resize Window option on Unix platforms running X – rightmost mouse button.)

Run



Clicking on the Run button sends the operation displayed in the Server Operation pulldown list to the server. While the operation is being carried out, most of the remaining buttons are disabled.

Stop



Clicking on the Stop button will stop the current operation. There may be a delay between the time the Stop button is clicked and the time that all operations cease, depending on the states of background processes.

Quit



Clicking on the Quit button causes Net-Archive to exit. A confirmation dialog box will appear, allowing you to cancel the quit operation.

Auto Backup

A rectangular button with a grey gradient background and a dark border. The text "Auto Backup" is centered on the button in a white, sans-serif font.

Clicking on the Auto Backup button starts a backup process using the current settings. A list of files to be backed up is first created, based on the file modification times being later than the most recent backup times of the files. While the backup process proceeds, you are free to use other applications. Backup progress is displayed in the Net-Archive Main window.

See sections 2.1.3 and 2.1.4 covering the Setup window and the Backup window for information on the settings used by Auto Backup.

Backup



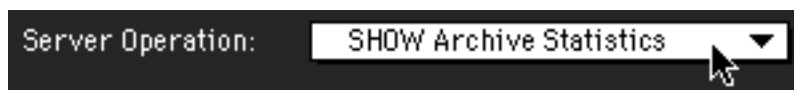
Clicking on the Backup button invokes the Backup window, which helps you compose a list of files and directories that will form the backup list. See Section 2.1.4 for a description.

Restore



Clicking on the Restore button invokes the Restore window. See Section 2.1.5 for a description.

Server Operation Pulldown List



The Server Operation pulldown list is used for selecting an operation to be performed by the server. This is an alternate mechanism for interacting with the server than using the buttons, and supports additional features.

After selecting an operation and filling in the Parameter fill-in field (if a parameter is needed for the selected operation), the Run button should be clicked, which sends the operation request and any parameters to the server.

The server operations are described below:

LIST User Archives

List the archives (one for each “Archived System” name used in the Setup window) associated with this user on the Net-Archive Server.

SHOW Archive Statistics

This operation queries the archive for its capacity, load factor, and other operational statistics. A more detailed response is given when the user is in Superuser mode.

SHOW Archive Contents

Show the names of the files in the archive. The Parameter field specifies a file or directory of interest, or a wildcard (*), which specifies all files and directories.

BACKUP Modified Files Only

A local “address book” keeps track of when files are backed up. The address book is compared with the modification times of files in the backup list, and any files

that pass this screening that have been modified since the last backup are uploaded to the archive.

BACKUP All Files In List

All files in the backup list are backed up, regardless of the file modification times.

RESTORE File(s)

Restore the file or directory listed in the Parameter fill-in field to the restore directory. An asterisk (*) restores all files and directories in the archive.

REMOVE File From Archive

Remove the file or directory specified in the Parameter fill-in field from the archive. An asterisk (*) in the Parameter fill-in field removes all files and directories associated with this user from the archive.

CLEAN

Over time, local files may be deleted that are still stored in the archive. The CLEAN operation compares archived files with the local file system, and removes any files from the archive that are not in the local file system. The Parameter fill-in field specifies the file or directory to compare, or an asterisk (*) to check all files and directories in the archive.

Change Password

Change the user's password to the string in the Parameter fill-in field.

Superuser: Change User ID

Change user ID to the string shown in the Parameter fill-in field. This only changes the user ID in the server password file. It does not change the tags on the stored files, which will no longer be accessible, though they will remain in the archive. This is best used before the user makes an initial backup. Requires superuser status.

Superuser: Kill Server

Kill the Net-Archive Server process. Requires superuser status.

Superuser: Add User

Add user ID to the server's password file with password. The user_ID:password pair is entered into the Parameter fill-in field before sending the operation to the server. Requires superuser status.

Superuser: List All Archives

List all archives and the corresponding address books on the server that belong to all users. Requires superuser status.

Superuser: Address Book

The address book lists the names of all of the files in an archive. This operation inspects the server address book (not the local client address book) for a specific user in the archive. The address book name would normally be obtained from the Superuser:List All Archives operation (above). Requires superuser status.

Superuser: Get Password File

Dump the server's password file to the client. If the password file is so large that it extends beyond the scrollable area of the status window, then the `NA_history` file (in the Net-Archive application folder) can be opened with a text editor to see the full contents. Requires superuser status.

Menubar

The menubar is displayed only in the Net-Archive Main window. The menus are described below. Any menu item that ends with an ellipsis “...” indicates that a dialog box is displayed.

File Menu

About Net-Archive... This menu item displays administrative information about Net-Archive, such as the current version and the product identification code. There are three version digits as in 1.0.0, but the rightmost digit is not displayed unless it is nonzero.

Help... This is an alternate path to the Help window.

Save Settings Selecting this menu item saves all of the user selectable fields and checkboxes in all windows, whether open or not, in the preference file `prefFile`, which is located in the same directory (folder) as the Net-Archive Client application. These settings will persist for future sessions, or until the next time this menu item is selected.

Optimize Sort the local address book so that the most recently accessed records appear first. The least frequently accessed filenames are removed from the list (but not from the archive) to improve performance. This operation is normally invoked after a backup operation completes, and there should be no need to invoke this operation manually unless a series of successive backup operations are not completed.

Quit... This is an alternate path to the Quit dialog box describe earlier.

Edit Menu (not available for Win 95/NT)

The Edit menu items are described below:

Cut The Parameter fill-in field can be edited. The Cut menu item deletes the text selected in either the Parameter fill-in field or the Status window as appropriate, and copies the deleted text to an internal buffer that can be pasted into the Parameter fill-in field.

The Status window is only used for displaying information, but the Cut operation is allowed for this text area to simplify how text is composed that gets copied into the Parameter fill-in field.

Copy The Copy menu item copies the selected text from either the Status window or the Parameter fill-in field into an internal buffer that can be pasted into the Parameter fill-in field.

Paste The text contained in the internal buffer, which was placed there by the most recent Cut or Copy operation, is inserted into the Parameter fill-in field at the insertion point.

Clear The Clear menu item deletes the currently selected text, without saving the text to the internal buffer.

Window Menu

The Window menu items are described below:

Help... This is an alternate path to the Help window.

Setup... This is an alternate path to the Setup window.

Backup... This is an alternate path to the Backup window.

Restore... This is an alternate path to the Restore window.

Configuration Wizard... This is an alternate path to the Configuration Wizard window.

Expert Menu

The Expert menu items are described below:

Easy Interface Use the simpler form of the Net-Archive Main window (Figure 2-1).

Expert Interface Use the advanced form of the Net-Archive Main window, showing the additional buttons and fields (Figure 2-2).

Resume AutoBackup Net-Archive Client can be configured to automatically initiate a backup according to the schedule created in the Setup window. If the user interrupts an automatic backup (an “Auto Backup”) then this option will

return the window to its iconified state that is used during an Auto Backup, as long as other operations have not been invoked since the Auto Backup was interrupted.

Other Fields

The Net-Archive Main window contains additional elements:

Parameter Fill-In Field

The Parameter fill-in field accepts keyboard input, and is used for some of the server operations, such as the name of a file (or directory) to restore. An asterisk (*) serves as a wildcard for a number of operations (meaning “all files”).

Progress Field

This field indicates the elapsed time and percentage of progress for backup and restore operations.

Faster Transfers Checkbox

Enabling this checkbox gives Net-Archive the full use of your network connection. By disabling this checkbox, a delay is inserted after every packet is sent or received over your network connection. Backups will take approximately four to five times longer while the checkbox is not enabled, but this frees your connection when you need a faster response for your other applications, while still making backup progress.

This checkbox can be toggled at any time, either during a transfer or between transfers. During typical usage, the effect of enabling faster transfers for backups should not be noticeable.

Ready/Status Field

The Ready/Status field displays the operation currently taking place, or displays “Ready” when no operation is taking place. An animated bead moves from left to right indicating that an operation is taking place. The bead jumps when a heavy background task is taking place either in Net-Archive or in some other program.

2.1.2 The Help Window

The Help window is shown in Figure 2-3. The Help window displays content that is similar to this chapter. Topics can be selected in the window on the left, and a textual/graphical explanation is displayed in the window on the right that corresponds to the topic. When you are finished with the Help window, click on the Done button.

2.1.3 The Setup Window

The Setup window is shown in Figure 2-4. There are several buttons, checkboxes, and fill-in fields in the Net-Archive Setup window, as described below.

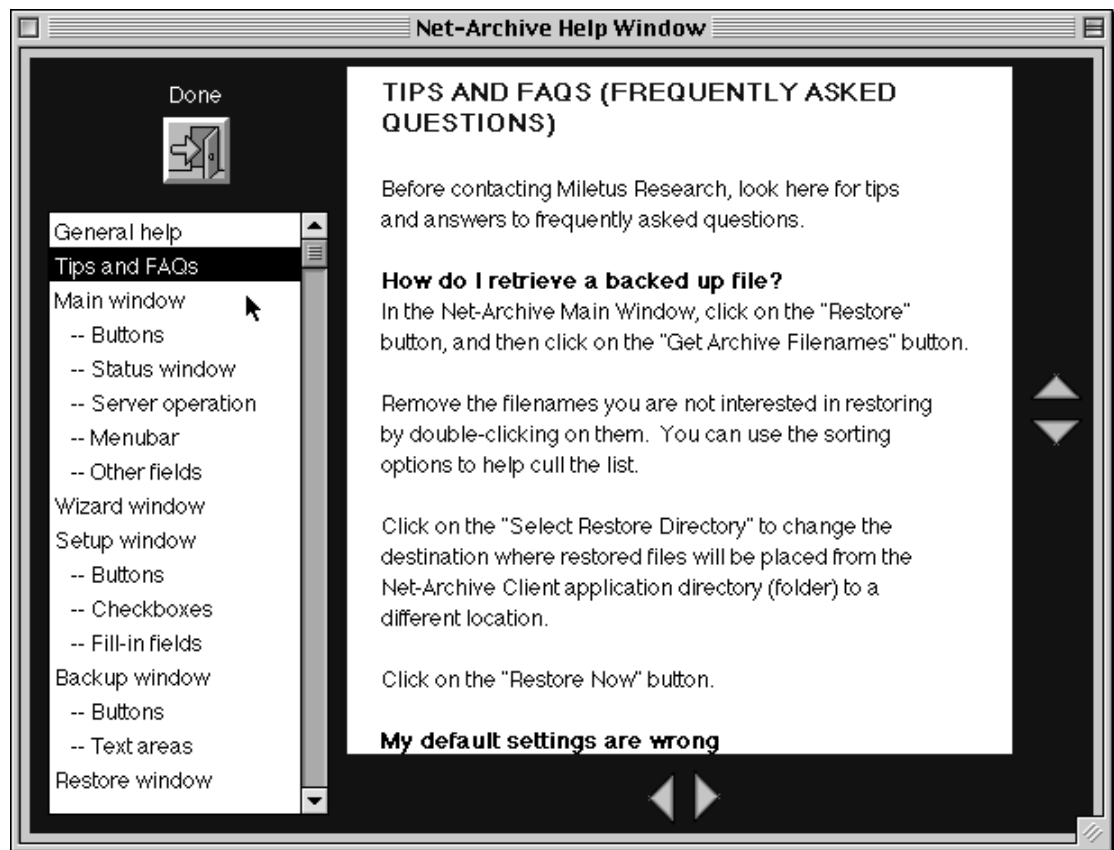


Figure 2-3: *The Help window.*

Setup Window Buttons



Clicking on the HELP button displays the Help window described in Section 2.1.2.

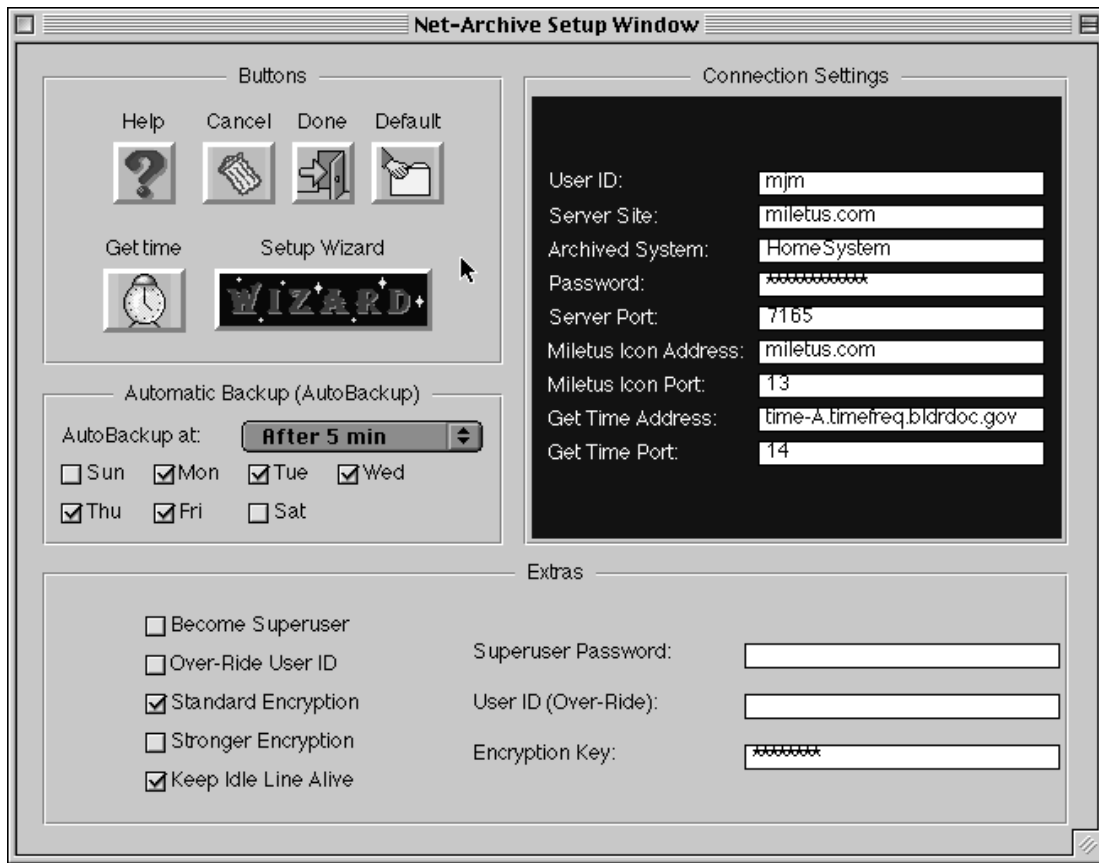


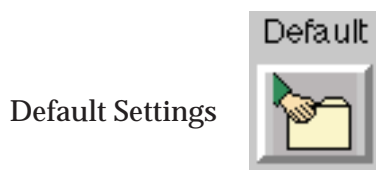
Figure 2-4: *The Net-Archive Setup window.*



Selecting the Cancel button closes the Setup window, with no changes recorded.



Selecting the Done button closes the Setup window, retaining any changes that were made (but not saving them permanently unless the Save Settings menu item is selected in the Net-Archive Main window.)



Selecting this button resets all of the parameters, checkboxes, and fill-in fields to their initial "out-of-the-box" values.

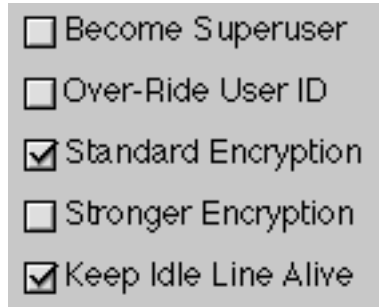


Maintaining accurate time is important for computing backup lists based on modification times. When the Get Time button is selected, the local time is displayed according to a server at the National Institute of Standards and Technology (NIST) in Boulder, Colorado (USA). The adjustment needed to synchronize your computer's clock to the NIST reference is then displayed. You can adjust the time using the appropriate Control Panel on a Macintosh or Windows 95/NT machine, or using the `date` command in superuser mode on a Unix machine.



Selecting the Wizard button invokes the Wizard window, which guides you through the setup procedure for the basic options.

Setup Window Checkboxes



- Become Superuser
- Over-Ride User ID
- Standard Encryption
- Stronger Encryption
- Keep Idle Line Alive

Become Superuser

Enabling this checkbox places the user in superuser mode (for privileged users). The password in the Superuser password fill-in field is verified by the server when the next request is sent to the server. Superuser mode allows the user to set up accounts for other users and to monitor the state of the server archive.

Over-Ride User ID

In superuser mode, the user can assume the identity of another user. This is helpful for setting up accounts and assisting other users.

Standard Encryption

All user data is encrypted by forming a bitwise exclusive-OR with the user-supplied encryption key. The key should be at least eight characters long to protect against a brute force cryptoanalytic attack. Shorter keys will work, but a warning will be displayed alerting you to the short key. Standard encryption and stronger encryption (see below) cannot be simultaneously enabled.

Stronger Encryption

All user data is encrypted with a randomly generated 257 byte key. The key is embedded in the client application, and is unique to the product identification code. The user supplied encryption key in the standard encryption key fill-in field is exclusive-ORed with both the 257 byte key and the user data.

All clients with the same product identification code and the same encryption key can communicate securely with stronger encryption. This means that your users need to have copies of your Net-Archive Client program, and not a copy that has a different product identification code. If your users have a different copy, then you can still communicate but you can only use standard encryption, because the 257 byte internal key will be different between you and your users.

Stronger encryption and standard encryption cannot both be enabled (because stronger encryption already incorporates standard encryption.)

Keep Idle Line Alive

Some Internet service providers automatically disconnect your line after a period of inactivity, such as 15 or 30 minutes. This can be a nuisance if you get distracted for a short period of time, and return to your computer ready to continue and then find that you have to reconnect.

When this box is checked, a simple "KeepAlive" request is sent to the Miletus Research time server every 3 minutes, which responds with the current time. This generates just enough network traffic to keep your line up. Some ISP's disconnect your line after a few hours regardless of usage, but this option will at least get you that far.

Setup Window Fill-In Fields

User ID:	mjm
Server Site:	miletus.com
Archived System:	HomeSystem
Password:	xxxxxxxxxxxx
Server Port:	7165
Miletus Icon Address:	miletus.com
Miletus Icon Port:	13
Get Time Address:	time-A.timefreq.bldrdoc.gov
Get Time Port:	14

User ID

This is the user ID as you are known in the server archive. The default user ID is "guest". This default user ID can be administratively disabled by changing the password for `guest` while in superuser mode.

Server Site

This is the IP name (or equivalently, the IP address) of the Net-Archive server.

Archived System

This is the name that the local system goes by. By changing the name in this field, the local system can appear to be any other system that is known to the archive. This is useful for uploading from one system and downloading to another.

Password

This is the password that goes with the user ID. The password is displayed as dots (•) or asterisks (*) (depending on your platform) for security reasons, and is stored in the preference file `prefFile` in encrypted form. You can thus safely archive your `prefFile`, which stores your password, without using any of the encryption options and still be protected against eavesdropping.

Server Port

The server port determines which server process (there can be many) at the archive site you are using. For Net-Archive Client users, the port number should be listed on the bottom half of your registration card if you purchased Net-Archive Client from Miletus Research, or should otherwise have been given to you by a Net-Archive Server administrator. There is a guest server port at Miletus Reserch (`miletus.com`) that can be used for testing: 7165. Please keep in mind that the Net-Archive Server running on this port is not secure, is publicly accessible, and is periodically cleared.

Miletus Icon Address

The IP name (or equivalently, the IP address) of the site used for testing the network connection can be changed from `miletus.com` to another IP name or address. This address is used when the Net-Archive button is selected in the Main Window. You will need to change this to a local network address if you are operating Net-Archive Client behind a firewall.

Miletus Icon Port

The TCP port used for testing the network connection can be changed from 13 (the daytime server) to a TCP port of the user's choosing. This port is used when the Net-Archive button is selected in the Main window. There should be a process running on this port that sends a newline terminated ASCII string immediately after establishing a connection. The daytime server on port 13 is standard across machines running TCP/IP, and so port 13 is recommended.

Get Time Address

The IP name (or equivalently, the IP address) of the site used for time synchronization can be changed from the default NIST server to another IP name or address. The string returned by the NIST server is syntax-specific and so it is not recommended that any changes be made to this field unless the new server adheres to the NIST syntax.

Get Time Port

The TCP port used for time synchronization can be changed from the default port of 14 to another TCP port.

Superuser Password:	<input type="password"/>
User ID (Over-Ride):	<input type="text"/>
Encryption Key:	<input type="password" value="*****"/>

Superuser Password

This is the password used for superuser status (for Net-Archive Server administrators). The password is displayed as dots (•) or asterisks (*) (depending on your platform) for security reasons, and is stored in the preference file `prefFile` in encrypted form.

User ID (Over-ride)

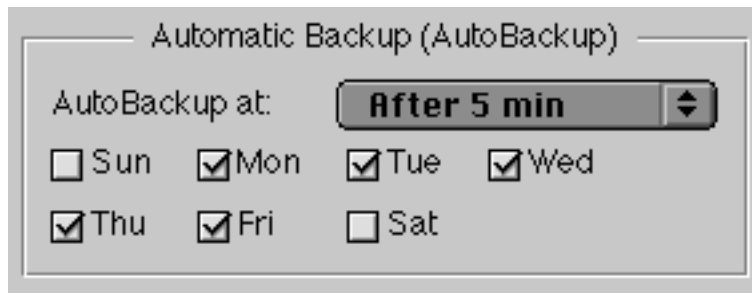
In superuser mode, the user can assume the identity of the user ID entered in this field.

Encryption Key

The encryption key is used both for standard encryption and for stronger encryption. If a key that is less than 8 characters long is entered into the Encryption Key field, then a warning message is displayed explaining that a short key is vulnerable to a brute force cryptanalytic attack. The key can still be used, but the warning message will recur unless the short key is lengthened to at least eight characters, or the key is cleared to zero length (which is still OK for stronger encryption, in which case only the product identification code-specific 257-byte key is used), or encryption is disabled.

Automatic Backup

The Automatic Backup (AutoBackup) area configures parameters that allow Net-Archive to automatically perform backups at scheduled times. Any combination of days can be selected, as well as a specific time of day, or alternatively, after the program is started rather than at a specific time. Choose the schedule that best suits you and the times that your machine is most likely to be connected to the Internet. Net-Archive will automatically initiate your network connection if you have configured your SLIP or PPP connection to make automatic connections.



AutoBackup at:

When this pull-down list is configured to allow automatic backups, the backup process will start either when Net-Archive is invoked, or at a specific time of day, using the previously saved settings. The client program can be placed in a list of items that are started when the host computer boots up and Net-Archive can then do its work silently, in the background.

The recommended AutoBackup choice is to select “After 5 min” which will initiate the backup process 5 minutes after booting your system. This allows you to establish your network connection and begin higher priority applications before starting any backups.

On a Macintosh, the way to place Net-Archive in the startup application list is to create an alias to Net-Archive, and place the alias in the `Startup Items` folder in the `System Folder` on your startup disk.

On a Windows 95 or Windows NT system, the way to place Net-Archive in the startup application list is to create a shortcut to it, and place the shortcut in the `Windows\Start Menu\Startup` folder on your startup disk (typically drive C.)

On a Unix system, the way to place Net-Archive in the startup application list is to place the command line `net-archive` in your `.xinitrc` file in your home directory.

2.1.4 The Backup Window

The Backup window (Figure 2-5) allows you to compose a list of files and directories that form the backup list. A list of files and directories to exclude is also composed, which over-rides any files or directories that appear in the backup list. If a directory appears in the backup list, and a file that is contained in that directory appears in the exclude list, then all files in that directory will be backed up except for the file that appears in the exclude list.

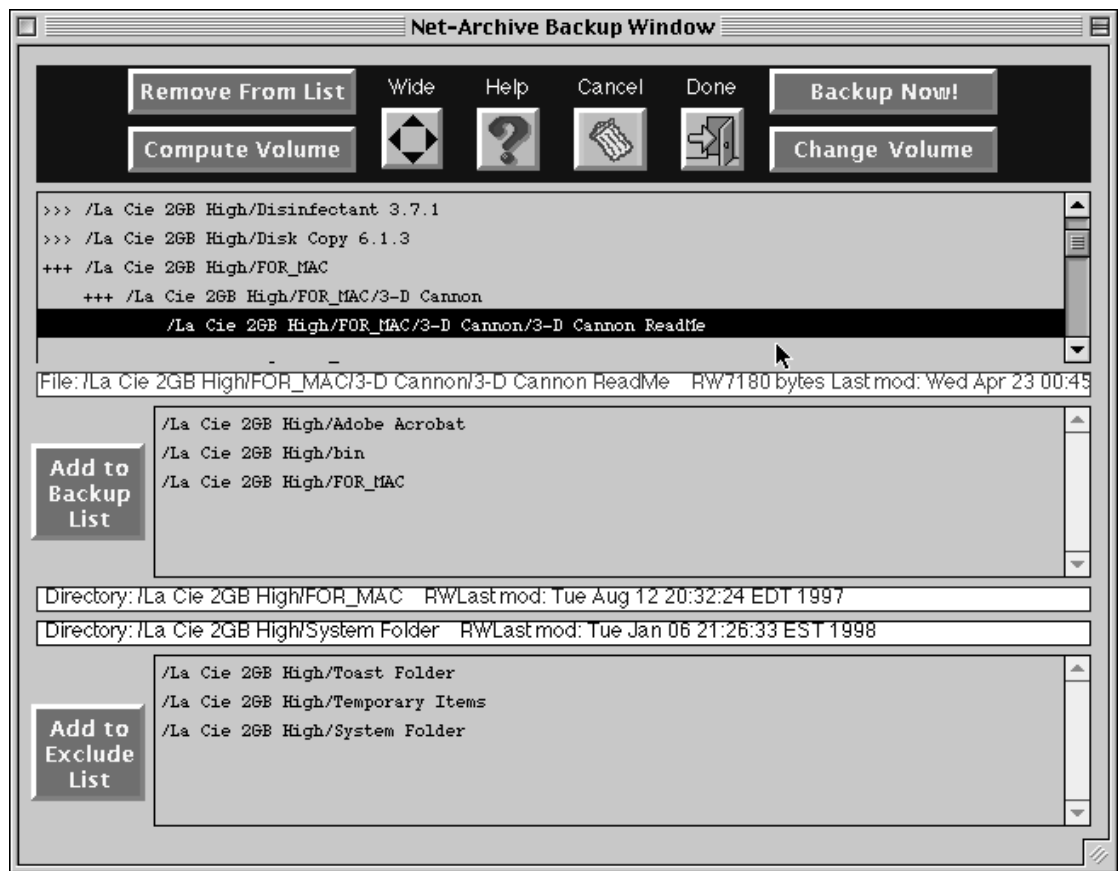


Figure 2-5: *The Net-Archive Backup window.*

Backup Window Text Areas

The backup window has three subwindows, three single-line text areas, and nine buttons (ten buttons on a Macintosh). The top subwindow displays the contents of the current directory. The middle subwindow shows the contents of the backup list. The bottom subwindow shows the contents of the exclude list.

Each of the subwindows has a single-line text area associated with it. Single-clicking on any item in a subwindow updates the single-line text area associated with that subwindow with information about the selection.

Double-clicking on a closed directory or folder (indicated by ">>>") in the top subwindow opens the directory (indicated by "+++"), and the contents of the directory are then displayed with a deeper indentation. Double clicking on an open directory closes it, but only if there are no deeper directories that are also open.

Backup Window Buttons

Compute Volume




Selecting this button computes the volume of data to be archived. The computation only considers changed files, based on the modification times of files in the backup list. This is the raw backup volume – compression will reduce this, but the amount of reduction will not be known until the files are compressed and uploaded (compression is not enabled in version 1.0).

Depending on the size of the backup list, this computation can take several minutes (but you can use other applications while the computation is carried out.) This same list is used by the backup process, so no time is wasted if you compute the backup volume first before doing the backup.

If you select the Compute Volume button when the volume has already been computed, then a message is displayed showing the previously computed volume. Selecting the Compute Volume button immediately again causes the computation to be fully recomputed. This may be necessary if you modify files while a backup is taking place, for example.

Change Volume (For Macintosh Computers Only)



The file system on a Macintosh computer is handled differently than on a Windows 95/NT or Unix computer. All file selection activity is isolated to the current volume (the current disk, or disk partition), until the Change Volume button is selected. The current volume is changed by clicking on the Change Volume button, and then using the dialog window that pops up to locate a different volume by typing a period (.) and hitting the Save button as shown below:



This action does not actually save anything, nor does it create a file or directory named “.”. This is simply the mechanism by which volumes are selected on a Macintosh.

Wide/Thin



Some of the pathnames for file backups can be very long. Clicking on the Wide button expands the Backup window to the width and height of the user's screen, thus allowing lines to extend to the full screen width before wrapping around. The Wide button then changes to Thin, which restores the Backup window to its initial size when clicked.

Remove From List



Clicking on this button will remove the most recently selected item from either the backup list or the exclude list (but not both).

Help



Clicking on the Help button displays the Help window. See Section 2.1.2 for a description.

Cancel



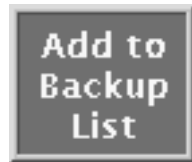
Clicking on the Cancel button will exit the Backup window, leaving the backup list and the exclude list unchanged.

Done



Clicking on the Done button records any changes made to the backup list and the exclude list, and returns to the Net-Archive Main window. The changes will be used for the remainder of the session, but will not be made permanent unless the Save Settings menu item is selected in the Net-Archive Main window.

Add To Backup List



Clicking on this button will add the item currently selected in either the top subwindow or the exclude list subwindow to the backup list. If the selected item is in the exclude list, then it is also removed from the exclude list.

Add To Exclude List



Clicking on this button will add the item currently selected in either the top subwindow or the backup list subwindow to the exclude list. If the selected item is in the backup list, then it is also removed from the backup list.

Backup Now!



Start the backup process, using the settings displayed in the Backup window.

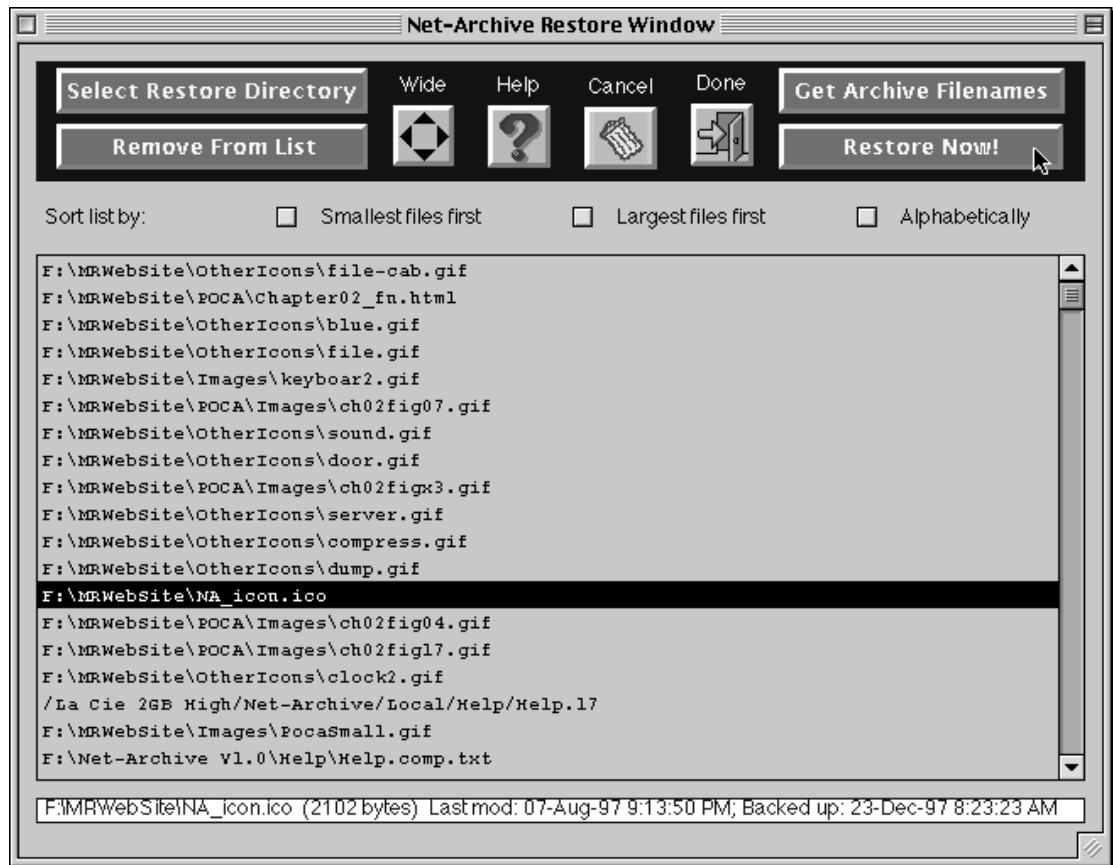


Figure 2-6: *The Net-Archive Restore window.*

2.1.5 The Restore Window

The Restore window is shown in Figure 2-6. The various Restore window elements are described below.

Restore Window Buttons

Select Restore Directory

Select Restore Directory

This button selects the directory in which restored files are placed, when a restore request is sent to the server. On a Macintosh, the same mechanism is used for selecting a restore directory as for the Change Volume button described for the Backup window.

Remove From List

A rectangular button with a dark grey background and a thin white border. The text "Remove From List" is centered in a light grey, sans-serif font.

This button removes the selected entries from the list of files to be restored.

Get Archive Filenames

A rectangular button with a dark grey background and a thin white border. The text "Get Archive Filenames" is centered in a light grey, sans-serif font.

This button sends a request to the server for all filenames belonging to the user that are stored in the archive. The filenames are displayed in the window, sorted according to the checkbox settings.

Restore Now!

A rectangular button with a dark grey background and a thin white border. The text "Restore Now!" is centered in a light grey, sans-serif font.

When this button is selected, a request is sent to the server to restore all of the files that appear in the window.

Wide/Thin



Some of the pathnames for restore operations can be very long. Clicking on the Wide button expands the Restore window to the width and height of the user's screen, thus allowing lines to extend to the full screen before wrapping around. The Wide button then changes to Thin, which returns the Restore window to its initial size when clicked.

Help



Clicking on the Help button displays the Help window. See Section 2.1.2 for a description.

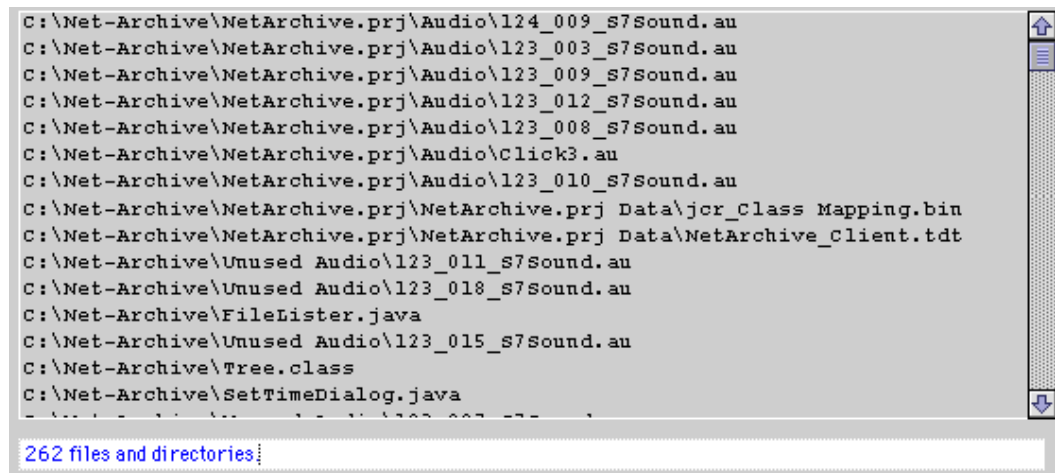


Clicking on the Cancel button exits the Restore window, leaving the restore list unchanged.



Clicking on the Done button records any changes made to the restore list, and returns to the Main window. The changes to the restore list will be used for the remainder of the session, but they will not be made permanent unless the Save Settings menu item is selected in the Net-Archive Main window.

Restore Window Text Areas



The Restore window has one large text area where pathnames to be restored are displayed, and a one-line text area beneath it where specific information on a file is displayed.

Initially, the large text area will be blank unless a restore list was previously saved. Filenames are entered into the text area by selecting the Get Archive Filenames button, which sends a request to the server for all filenames stored in the archive. The full pathnames to each file are then displayed.

Information on a single file, such as its size and backup time can be obtained by single-clicking on it. Double-clicking on a pathname removes it from the list.

When the Restore Now! button is selected, the files are restored one-by-one, and the corresponding pathnames are deleted from the restore list as progress is made.

Restore Window Checkboxes

The Restore window contains three checkboxes that determine how the restore list is sorted:



The default setting is for no sorting to take place: pathnames are displayed in the order they are received from the server. The pathnames can be sorted so that the largest or smallest appear first in the list, depending on which of the two corresponding checkboxes are enabled. The pathnames can also be sorted alphabetically. Alphabetical sorting can be combined with sorting by largest or smallest first, in which case alphabetical sorting is always applied last. For long lists (1000 or more pathnames) alphabetical sorting may incur a noticeable delay.

2.2 A FEW DETAILS

This section explains a few details about the client module.

2.2.1 Compression

[Compression is not enabled in version 1.0.]

Almost every file contains redundant information, no matter what type of data the file contains. For example, the word “the” appears frequently in this document. Every place where “the” appears, there is a three-letter sequence “t”, “h”, and “e”. There is also an implicit indication of the position of the three-letter sequence by virtue of where it appears.

If we record the three-letter sequence “the” just once, and maintain a list of locations (represented by indices into the document) where “the” appears, then we can compress this redundancy out of the file. The result will be a smaller, compressed file that takes less time to transmit and receive, and which consumes less space in the archive.

Your Net-Archive software provides two user-selectable compression options: Standard Compression and Better Compression. If no compression is selected, then no compression is applied to uploaded files. This does not affect how files are restored from an archive: Net-Archive automatically figures out if restored files need to be decompressed and does the right thing.

Standard compression implements “adaptive Huffman encoding” by looking at (up to) the first 100 KB of a file, determining the “codebook” to apply to the file, and then uploading the codebook along with the file.

Compression requires computer resources in the form of computer time, plus the storage needed by the codebook that is used for standard compression which requires 1 KB of storage. For efficiency purposes, compression is automatically disabled for files less than 10 KB in size or if the compressed file is larger than the original file (which can happen if you try to compress a compressed file.)

The adaptive Huffman implementation in Net-Archive results in compressed files that are typically 70%-85% of their original size. “Dynamic Huffman encoding” is a more sophisticated approach that provides better compression ratios, but takes more time to compress (and less time to transmit). Dynamic Huffman encoding is used for the “Better Compression” check box.

The average connect time on a dialup modem is approximately 30 minutes. With a 9% upstream utilization on a 28.8K modem (see Appendix A for how this measurement was obtained), the average upload volume that can be accommodated without disturbing the user is $28,800 \text{ bits/sec} \times 1/10 \text{ bytes/bit} \times (60 \text{ sec} \times 30 \text{ min}) \times 91\% = 4.7 \text{ MB}$ (note that for transmission purposes, a byte is assumed to have 10 bits instead of the traditional 8 bits, because each byte is typically padded with a start bit and a stop bit.) Adaptive Huffman encoding increases this to 8 MB, and dynamic Huffman encoding increases this to 10 MB, assuming the action of compression does not appreciably slow down your computer.

Compression inevitably does slow your computer, and in fact, it would be faster to disable compression since the Better Compression method is currently implemented in almost all high speed modems. The only real gain that software compression realizes is reduced storage volume on the server.

2.2.2 The Preference File

The default Net-Archive settings are stored in a file named `prefFile` in the same directory as the Net-Archive Client application. The `prefFile` file contains ASCII readable parameters such as the backup source list, as well as encrypted versions of your encryption keys. The use of encryption for the keys allows your keys to be securely stored in an otherwise readable file.

It is important to back up the `prefFile` file so that you can retrieve this from another machine later on. It is also important to understand how the encryption methods are applied in order to do this effectively: if you disable all encryption, then anyone can access your archive from anywhere; but if you use stronger encryption on everything you archive, including the `prefFile` file, then you will be unable to retrieve your archive from another machine using a Net-Archive client with a different product identification code because the encryption key is encrypted with an internal key that is

specific to your product identification code, making it virtually impossible to retrieve your encryption key, unless your key is stored somewhere else (or you commit it to memory).

The solution is simple: Use standard encryption when backing up `prefFile`, and then you will only need to remember the standard encryption key. Since the internal stronger encryption key is generated on your own computer using a pseudo-random number generator, **there is no way to reconstruct this key through any other means than to get another copy of the Net-Archive Client program with the same product identification code.** If your machine is lost, then so is your archived data, because an attempt to try to deduce your stronger encryption key from the data will be impractical. (You can always get another copy of your Net-Archive Client program from Miletus Research, but to get your same product identification code, it will take some work to convince us you are not trying to attack an archive you do not own. This is where your product registration card is very important. Be sure to send it in!)

Again, the simple solution is to use standard encryption for everything. In fact, you can use no encryption at all and still have secure key storage: Net-Archive uses a private key, derived from your product identification code, that encrypts the keys that are stored in the `prefFile` file. (Go ahead and check! The `prefFile` file is readable in most word processing programs.)

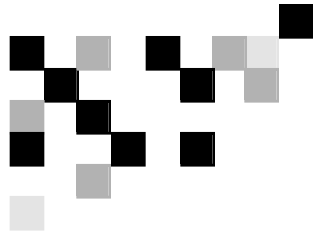
2.2.3 Force-Quit

Sometimes a computer will “lock up” and you will be unable to stop the program that is running. This is not a situation peculiar to Net-Archive, but in fact, is a general problem for all Macintosh and Windows programs, and Unix programs to a lesser degree, because programs can interact in unintended ways.

A simple remedy is to “Force-Quit” the application affected by the lock-up. On a Macintosh this can be accomplished by depressing the three-key combination `cmd + SHIFT + ESC` where “cmd” is the command key (not the control key). If Net-Archive is the program affected by the lockup, then it will simply quit without finishing its current operation. You will have to restart Net-Archive in that case, and it will continue any backup operation where it left off.

On a Windows 95 or Windows NT machine, this can be accomplished by typing `Ctrl+Alt+Delete`.

On a Unix machine, this can be accomplished by typing the kill character. The kill character differs from one user to the next, but typical defaults are `Ctrl+C`, `Ctrl+\`, and `Delete`.



USING NET-ARCHIVE SERVER

3

3.1 THE SERVER MODULE

If your package includes Net-Archive Server, then this chapter is for you. The next few sections explain how to set up and administer your server software.

3.1.1 Unpacking the Net-Archive Server Module

If you have not already set up your server software from the enclosed CD-ROM, then please return to Chapter 1 and follow the Net-Archive Server setup procedure. The server can also be downloaded from the Miletus Research Web site <http://www.miletus.com> by selecting the Download Software link. The server software is packaged as a single tar file for a number of Unix systems. Supported server platforms include Linux, SunOS, Solaris, HP-UX, and IRIX. Other Unix platforms may have been added since this writing and so you should check the Miletus Research Web site if you do not see your platform listed here.

After you download or copy the software to your Unix machine, you can unpack it with the Unix command line:

```
% tar -xvf net-archive_server.solaris2.tar
```

This example is for Solaris 2. The name of the tar file that you use will differ if you have a different operating system than Solaris 2. The archive software takes up approximately 10 MB for all of the code and support files, plus additional storage that you set aside for the archive.

3.1.2 Configuring Net-Archive Server

There are a few files that need to be manually configured before starting your server. These files are:

`motd.txt` – Message of the day. The contents of this file are displayed when a client connects to your server.

`crontab` entry – This file is part of your Unix system; it is not part of the Net-Archive distribution. If you want your server to automatically restart on a system reboot or when your server gets administratively killed, the `crontab` entry configures this behavior.

`password_file` – This file should not be manually configured, although it may appear to be possible because its contents look like ordinary ASCII text. It should be configured entirely with the Net-Archive Client application while in superuser mode. It *can* be manually edited, if great care is taken in maintaining a uniform record size of 81 bytes (exactly), which includes a terminating newline character (there is no carriage return.)

There are Unix manual (`man`) pages for the server module, and also a “bare bones” Unix command line client. The manual pages should be placed in `/usr/local/man/man1` on your Unix system, if you have write privileges in that directory. You can do this with:

```
% cd <directory where net-archive_server was untarred>
% cp net-archive.1 /usr/local/man/man1/net-archive.1
% cp net-archive_server.1 /usr/local/man/man1/net-archive_server.1
% chmod 0644 /usr/local/man/man1/net-archive*
```

The `crontab` entry can be edited by executing

```
% crontab -e
```

Your default editor will be invoked with an empty window if you have no existing `crontab` entries. Type the following text into that window and then save-quit out of your editor. (Be sure to avoid inserting any blank lines, or any blank spaces at the beginning of any lines):

```
7,22,37,52 * * * * /pathname/cronentry
```

in which “`/pathname/cronentry`” is a path to a file named “`cronentry`” that you create as described below.

Your Unix system should be running the `cron` daemon, which will execute the above line at 7 minutes past the hour, 22 minutes past the hour, 37 minutes past the hour, and 52 minutes past the hour, every hour of every day, week, month, and year. You can change these times as you prefer.

Your `cronentry` file should be executable by all, and should contain the lines:

```
#!/bin/sh
RUNNING=`/bin/ps -ef | grep net-archive_server | grep -v "grep"`
if [ "$RUNNING" = "" ]; then
net-archive_server > errfile
fi
```

This is for Solaris 2, Linux, IRIX, and HP-UX. For SunOS 4 replace “-ef” with “-axwvl”.

This will start your server with the default settings, if it is not already running. Make sure that `net-archive_server` is in the `PATH` for the cron daemon, otherwise, use the entire pathname in the command (i.e. `/usr/local/bin/net-archive_server > errfile`).

You can make the `cronentry` file executable with:

```
% chmod o+x cronentry
```

The `motd.txt` file can be edited as an ordinary text file. It is a good idea to keep this file short, since the default display size in Net-Archive Client shows approximately 10 lines, and you do not want your users to have to scroll up to find the beginning of the message.

The Net-Archive Client applications are capable of modifying the `password_file`, after the server authenticates that the client is in fact authorized to do this. Any modifications to the password file should be made using Net-Archive Client. The `password_file` file contains the names and passwords of your users in “cleartext” form, which means that it should be read-protected on the server system as appropriate for the access privileges of users on the server system.

3.1.3 Starting Net-Archive Server

The first time time that you invoke `net-archive_server` you will be prompted for the product identification code, which you should enter as listed on your product registration card, or as you obtained separately if you downloaded the software from the Web.

The `net-archive_server` application can be invoked from the command line, or via the `cron` daemon as described in the previous section, using the command line

options described in the man pages (see Section 3.3.) A typical command line invocation is shown below:

```
% net-archive_server -B /voll/archive -p 7165 -S 4000 -M \
motd.txt2 -N >& errfile &
```

The base directory where the working archive is stored is specified with “-B /voll/archive.” Change the argument for -B to the directory where your archive will reside. If the archive does not already exist in this directory then it will be created. The default base directory is /tmp (beware: /tmp is cleared on system reboots for some Unix systems, so you should specify a directory other than /tmp with the -B option.)

The password file is copied from the executable directory (where net-archive_server was untarred) to the working archive directory. Changes to the password file thus need to be made in two places if you want your users to have access to Net-Archive servers that you run on different ports on the same machine. The reason that it works this way is so that you can have a default password file that is initialized for each instance of the server, and then you can maintain separate password files for each instance in their respective directories. (Your License Agreement allows you to run multiple instances of net-archive_server on the same machine, but the ports and base directories need to be different for each instance.)

The default port for the server is 7165, and so the command line argument “-p 7165” is redundant in the example above. A “port” provides a means for a client to contact your server through the operating system. Ordinary users can usually claim any port higher than 5000 and below 32,768. Ports above 500 and below 1000 can be assigned locally, with root privileges.

The command line argument “-S 4000” specifies that the archive should be initialized to 4000 shreds if it needs to be created, or should be increased to 4000 shreds if it already exists and is smaller than 4000 shreds. In v1.0, a shred is a unit of 10,000 bytes, and so a 4000 shred archive can store $4000 \text{ shreds} \times 10,000 \text{ bytes/shred} = 40,000,000$ bytes. If the archive exists and is larger than or equal to 4000 shreds, then this argument has no effect. The default argument is 40,000 shreds if it is not explicitly given on the command line.

The “-M motd.txt2” command line argument identifies motd.txt2 as the message-of-the-day file. This file is read anew and is displayed on the client for each new connection. The file motd.txt2 can thus be edited at any time, and all subsequent connections will see the modified file. The default message-of-the-day file is motd.txt if it is not explicitly given on the command line.

The “-N” command line option allows new users to create their own accounts by specifying the Superuser: Add new user operation in the client program (-C oam_add_new_user in the command line client) with a parameter of

`user_ID:password`, which should be the same as what the user keys into the user ID and password fields in the client (this is `-A user_ID:password` in the command line client, in which `user_ID` must be the same as the Unix login username, and `password` must also be specified as `-P password`). This password has no relationship with the Unix login password.) Using the `-N` command line option is a good way to allow unregistered users to try one of your servers, so that you can run one instance of the server for trial subscriptions and another instance for a more privileged community without `-N` enabled. This is the way that the guest server at `miletus.com` (port 7165) works.

The `>& errfile` command line argument redirects any server output (stdout and stderr) to file `errfile`. This is in addition to any information that is sent to the server's log file.

The ampersand `&` at the end of the command runs the process in the background, and immediately returns you to the command line shell in the foreground.

In addition to the command line arguments described above, there are also `-h` and `-R` arguments. If `-h` appears anywhere on the command line, then a help message is displayed and the server then exits. No other operation is performed, and any other command line arguments are ignored. The `-R` option allows the server to be immediately restarted and avoid the TCP 2MSL wait. If you do not know what this means, then you should probably not use it.

The Unix man pages in Section 3.3 give more details.

3.1.4 A Minimal Command Line Client

A minimal Unix command line `net-archive_client` application is included that does not use a graphical user interface. The command line client can be run in batch mode, or in scripts, without prompting the user for input. This is only a partially featured client program. Notable features that are not available in the command line client that are available in the graphical clients are encryption, and translation among pathname formats for Windows 95/NT, MacOS, and Unix platforms.

3.2 ADMINISTERING NET-ARCHIVE SERVER

3.2.1 Passwords and Codes

There are three passwords/codes that are important to a Net-Archive Server administrator:

- server product identification code (imprinted on the bottom half of the product registration card);
- superuser password (default is "ZeusAthena");

- kill password (default is “Kerberos”).

The server product identification code is keyed to your software, but is not keyed to your computer. Thus, you can copy the Net-Archive Server module with supporting files to another machine and it will work OK there (your License Agreement allows you to do this, with a few restrictions.)

The superuser password and kill password are stored in cleartext form in file `net-archive_server.sup`, which can be edited before `net-archive_server` is invoked.

The server can be killed from `net-archive_client` in superuser mode if a valid kill password is provided. Alternatively, the kill password can be typed into the Parameter field of a graphical user interface (GUI) client, with the superuser password typed into the superuser password field in the Setup window of a GUI client (and the “Become superuser” checkbox should be enabled), and the “Superuser:Kill Server” pulldown list item should be selected before clicking on the “Run” button.

The server can be killed using the command line client with the following syntax:

```
% net-archive_client -P <password> -s <system_name> -p \  
<port_no> -O <superuser_password> -C kill -A <kill_password>
```

Take a look at the Unix man pages in the next section. The `net-archive_client` command line client program supports some important features for server administration that are not available with the GUI clients, even in superuser mode.

3.2.2 Logfile

A logfile is maintained in the archive directory that keeps track of the times that users connect to the server, where they connect from, and the general server activity requested. The log filename is `server_NetArchive.log`.

3.2.3 What do I need to give to my users?

Your users will need three things from you:

- (1) A copy of the Net-Archive Client software, which they can get from the CD-ROM or the Miletus Research Web site at <http://www.miletus.com>.
- (2) The port number on which you are running `net-archive_server`. The default port is 7165.
- (3) A product identification code.

A list of product identification codes that you may assign to your user community is enclosed in the Net-Archive Server package. Alternatively, users can obtain a new

product identification code via <http://www.miletus.com> on the Download Software link.

3.3 UNIX MANUAL PAGES

The server module is invoked from the command line on a Unix platform. It does not need a graphical user interface (GUI) environment, such as X, and can therefore be easily invoked in scripts or can be invoked from a “dumb terminal.”

The regular Net-Archive Client module that your users will use needs a GUI environment in which to run, but a minimal command line client is included with Net-Archive Server so that some operations can be executed without a GUI environment. This is a “bare bones” Unix command line implementation of Net-Archive Client that does not support the full set of features of the GUI versions. Most notably, the compression and encryption functions are not compatible between the GUI Net-Archive client and the Unix command line client. However, all of the administrative operations are cross-compatible, such as setting up user accounts and checking on archive operational statistics.

The major use of this command line version of the client module is to perform batch mode administrative operations, such as setting up user accounts, and checking on operational statistics such as the capacity of the archive.

The UNIX operating system uses “man” pages for online manuals. After installing the man pages in a common location (see the beginning of this chapter for installation instructions), the user can view the pages by simply typing at the shell prompt:

```
% man net-archive_client    (command line client man pages)
```

```
% man net-archive_server    (server man pages)
```

These pages can also be viewed directly from the distribution package prior to installation with:

```
% nroff -man net-archive_client.1 | more
```

and

```
% nroff -man net-archive_server.1 | more
```

These man pages are shown in the next few pages. Remember: the command line Net-Archive Client module is an entirely different program than the GUI Net-Archive Client application, with similar but not identical functionality.

NET-ARCHIVE_SERVER (1)

NAME

net-archive_server - Server program for Net-Archive system

SYNOPSIS

```
net-archive_server [-h] [-p tcp_port] [-B base_directory]
[-S no_shreds] [-M motd_file] [-R] [-N]
```

DESCRIPTION

The Net-Archive network archiving system is made up of a constellation of servers and clients. The net-archive_server program operates within the Net-Archive system as a server.

OPTIONS

- h
Display a help message and exit net-archive_server.
- p tcp_port
Use TCP port tcp_port. Default port is 7165.
- B base_directory
Use base_directory for the archive and temporary files.
The default base directory is ./Net-Archive.
- S no_shreds
Create an archive that is no_shreds shreds in size. If the archive already exists, then the size of the archive is increased to no_shreds. If no_shreds is less than the size of the existing archive, then this option has no effect. If the option is not specified, then the default archive size is given according to the local implementation, which is 40,000 shreds in the v1.0 release.
- M motd_file
Use motd_file for the ASCII text message that is displayed when a client connects to the server. The default motd (message-of-the-day) file is motd.txt.
- N
Allow unregistered users to start their own accounts.
- R
Re-use the TCP port before the 2MSL timer expires. Use great care that another server is not already using the port.

FILES AND DIRECTORIES

./Net-Archive The default directory for the archive and temporary files.

motd.txt The message-of-the-day file.

SEE ALSO

For more information on Net-Archive, see the Miletus Research home page at <http://www.miletus.com>.

NET-ARCHIVE_CLIENT (1)

NAME

net-archive_client - Client program for Net-Archive system

SYNOPSIS

```
net-archive_client [-h] [-p tcp_port] [-s server_name] [-U user_ID]
[-I home_system] [-P password] [-B base_directory] [-O OAM_password]
[-b OAM_become_user_ID] [-C command [-A argument]]
```

DESCRIPTION

The Net-Archive network archiving system is made up of a constellation of servers and clients. The net-archive_client program is a client that operates within the Net-Archive system. The major interactions involve uploading and downloading files and directories to and from a net-archive_server program. The net-archive_client program also operates in an operations, administration, and maintenance (OAM) mode that allows operational variables of the system to be observed and modified.

When net-archive_client is used for performing backups, an address book is maintained in the user's home directory that records the filenames and backup dates for files that have been uploaded to the archive. This address book is referenced for existing archived files whenever a backup is performed. If no changes have been made to a file since the last backup, then the file is not uploaded. There is no harm in repeatedly attempting to back up the same file, since the result will simply be an information message that no backup needs to be performed.

OPTIONS

-h

Display a help message and exit net-archive_client.

-p tcp_port

Use server TCP port tcp_port. Default port is 7165.

-s server_name

Contact the server using the DNS server_name or the IP address of the server in dotted decimal notation. Default server is miletus.com.

-U user_ID

Use the identity of user_ID. This is useful for users with Net-Archive user_IDs that differ from their login account names, or for users who exchange information among themselves using a common account name.

-I home_system

Treat the client system as home_system. This is useful

for restoring an archive that was uploaded from machine A onto machine B. The default assumes that the home system is the machine on which the client is currently operating.

-P password

Authentication password for client. Required for all users. This is typically a different password than is used for the login account on the client system, and should be different from the encryption keys.

-B base_directory

Use base_directory for Net-Archive temporary files (such as locks and restored files). Default base directory is /tmp/Net-Archive. (The user's login directory is used for two administration file types: the address book, and the name translation table, which have names such as: .Address_book.00001 and .name_trans_table.)

-O OAM_password

Superuser password for invoking OAM module. For privileged users only. This enables the -b flag (below) and a number of commands for the -C flag.

-b OAM_become_user_ID

After authenticating as an OAM client, the user_ID is changed to OAM_become_user_ID. This allows a system administrator to perform a backup or other operation on behalf of a user, without needing to know the user's password. Although the administrator can perform a backup or restore operation on a user's files, the administrator cannot read the contents of encrypted archived files, even if the encryption key is known, because this command line version does not support encryption.

-C command [-A argument]

Archiving commands are specified with the -C flag. Most commands take a single (optional) argument, which is specified with the -A flag. If the pathname argument is omitted from any of the commands described below, then the user's login directory is used by default. The commands currently implemented, and their arguments are:

COMMAND	ARGUMENT	DESCRIPTION
backup	pathname	Back up pathname (file or directory) to server archive,

		if it has been modified since the last backup.
fbackup	pathname	Same as backup command except that the backup is forced to take place even when the address book indicates no backup is needed. This is useful for making a backup of the same file or directory to multiple servers.
restore	pathname	Restore pathname from the server archive. Restored files are placed either in /tmp/Net-Archive/username or in the directory specified by the -B flag. If pathname is replaced with "all" then all files in the server archive are restored.
status	pathname	Show status of pathname prior to being backed up.
help	<none>	Print a verbose help message, then exit.
kill	kpassword	Kill server process.
remove	pathname	Remove pathname from server archive. If pathname is replaced with "all" then all files in the server archive are removed.
shownames	pathname	Show the names of all user files on server that begin with pathname. If pathname is replaced with "all" then all pathnames in the server archive are shown for the user on the home system, or the system specified with the

-I flag.

clean	pathname	Compare filenames starting with "pathname" on the client system with filenames stored on the server. Delete any server filenames that are not on the current system. This is needed when a file is deleted on the client system but is not explicitly removed from the archive.
password	new_password	Change password to new_password.
username	new_user_ID	Change user_ID to new_user_ID.

The following flags require OAM (superuser) status (the -O flag is required):

oam_archive_stats	[verbose]	Show (verbose) statistics on the server's archive.
oam_name_translation_table	[verbose]	Show (verbose) statistics on the server's name translation table.
oam_address_book	address_book_name	Show statistics on a server address book.
oam_add_user	user_ID:password	Add user_ID to the password file with password.
oam_remove_user	user_ID	Remove user_ID from the password file. Note that "-C remove -A all -b user_ID" should be executed with OAM status to remove a user's files.

oam_increase_archive	no_shreds Increase the size of the archive to no_shreds shreds. If the archive is already at least as large as no_shreds, then the archive size is not changed.
oam_get_password_file	Get the password file from the server.

EXAMPLES

Back up the user's home directory:

```
% net-archive_client -C backup -P pF45klt
```

Back up a specific directory:

```
% net-archive_client -C backup -A /ug1/mjm/mydir -P pF45klt
```

Show the filenames in the archive that are contained in a specific directory:

```
% net-archive_client -C shownames -A /ug1/mjm/mydir -P pF45klt
```

Back up the user's home directory, after a 3 hour delay:

```
% echo "net-archive_client -C backup -P pF45klt" | at now + 3 \
hours
```

Back up the directory /ug1/mjm to the Net-Archive server running on miletus.com on the default server port (7165), which is unspecified:

```
% net-archive_client -C backup -A /ug1/mjm -s \
miletus.com -P pF45klt
```

Restore the directory /ug1/mjm from the Net-Archive server running on soma.rutgers.edu (specified as an IP address in dotted decimal notation) on the default server port (7165), to the (default) /tmp/Net-Archive directory on the local system:

```
% net-archive_client -C restore -A /ug1/mjm -s 128.6.25.70 \
-P pF45klt
```

This next example backs up the directory /ug1/mjm to the Net-Archive server running on hp-ultra on port 8000, and identifies the archive as originating from the system "hp-yellow" (which does not have to exist) from user "Joe", which over-rides the default that identifies the

archive as originating from the client system and the default of using the user's \$LOGNAME environment variable. Note that user "Joe" must be registered in the password file, and that the password must be associated with user "Joe."

```
% net-archive_client -C backup -A /ug1/mjm -U Joe -I hp-ultra \  
-s hp-red.rutgers.edu -P pF45kl -p 8000
```

In this next example, a system administrator adds a new user to the system. Note that the user ID and password for the new user are catenated into a single colon separated string.

```
% net-archive_client -P sysadmin_password -O OAM_password -C \  
oam_add_user -A user_ID:pF45kl
```

A system administrator backs up a user's home directory. Note that the address book is maintained in the system administrator's directory, and not in the user's directory. This prevents the system administrator from clobbering the user's address book and vice versa (but may result in redundant backups of the same files, one for the user and one for the system administrator):

```
% net-archive_client -P sysadmin_password -O OAM_password -C \  
backup -U user_ID
```

EXCEPTIONS

If a backup operation causes an existing archived file to be overwritten, then the archived file is renamed by adding 128 to the first character of the pathname prior to the backup. The backup is then performed on the file, and the renamed file is removed. If a backup is interrupted, then the older version of the file can still be retrieved by adding 128 to the first character of the filename. For example, if the -A flag for the RESTORE command normally specifies filename "foo", in which "f" is at position octal 146 in the ASCII table (type % man ascii or see /usr/pub/ascii), then use "\036400" instead.

BUGS

The most significant problem is that this is a bare bones command line version of Net-Archive Client which does not have all of the features of the graphical user interface versions. Notable missing features are encryption, exclude lists, and translation among pathnames for the major platforms.

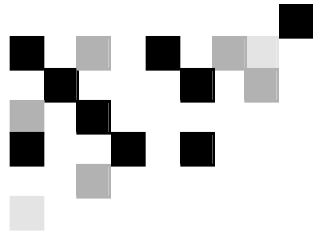
If a user backs up a file in /users/username/foo, and then later changes directories to /users/username and backs up foo, then there will be two copies of foo in the archive, one for each base directory.

FILES

/tmp/Net-Archive The default directory for temporary files.

SEE ALSO

For more information on Net-Archive, see <http://www.miletus.com>.



GETTING HELP

4

4.1 LOOK HERE FIRST (FREQUENTLY ASKED QUESTIONS)

Before contacting Miletus Research, look here for answers to frequently asked questions.

4.1.1 *My default settings are wrong.*

If your default settings get changed, then you can always use the following settings to connect to the guest server at Miletus Research:

Username = guest

Server Site = miletus.com

Password = miletusguest

Server port = 7165

Warning: the guest server is intended for testing purposes only. The contents of the guest archive are periodically cleared, so do not use these settings for your actual backups.

4.1.2 *I can't close a directory in the Backup window.*

This will happen if you do not close inner subdirectories first. Some of your subdirectories may be empty, but they still have to be closed before closing a higher level directory.

4.1.3 *I uploaded files from one machine, but I can't see them when I try to restore to another machine.*

Your files are “tagged” with the name of the machine from which they originate. This allows you to backup a file with the same name from two different machines, without having one copy overwrite the other. The `Archived System` fill-in field in the Setup window should be changed to the name of the source system during a re-

store operation, so that the server will make the archive from that machine available to you. Any non-whitespace character string can be used for the archived system name. Any white spaces in the system name will be automatically deleted.

4.1.4 Force-quit

Sometimes a computer will “lock up” and you will be unable to stop the program that is running. This is not a situation peculiar to Net-Archive, but in fact, is a general problem for all Macintosh and Windows 95/NT programs, and Unix programs to a lesser degree, because programs can interact in unintended ways.

A simple remedy is to “Force-Quit” the application affected by the lock-up. On a Macintosh this can be accomplished by depressing the three-key combination `cmd + SHIFT + ESC`. If Net-Archive is the program affected by the lockup, then it will simply quit without finishing its current operation. You will have to restart Net-Archive Client in that case, and it will continue any backup operation where it left off.

On a Windows 95 or Windows NT machine, this can be accomplished by typing `Ctrl+Alt+Delete`.

On a Unix machine, this can be accomplished by typing the kill character. The kill character differs from one user to the next, but typical defaults are `Ctrl+C`, `Ctrl+\`, and `Delete`.

4.1.5 Known bugs

- The use of the `Change Volume` button in the Macintosh client, for selecting backup sources and the restore directory, is a bit arcane and will disappear in a future release.
- If the command line Unix client uploads a directory in which the trailing slash (/) is included in the directory name (such as `/vol/user/dir1/`), then this wreaks havoc on the restore process which automatically appends a trailing slash to subdirectories and contained files. The solution is to omit the trailing slash when backing up directories in the command line client, or when using the `Parameter` field of the GUI versions.
- The error message: “Error mak154: connection reset by peer” should only happen in rare network traffic situations, possibly never for most users, but it can happen frequently in the Windows 95/NT environment if routing loops occur in your local network domain. The effect is that any transfer in progress is stopped, and the backup process will have to be restarted (from where it left off).
- If a filename contains a file separation character like (`\`) or (`/`), then it may not be restorable on a platform that treats the file separation character as such.
- Auto Backup works just once per application startup. That means that if you configure automatic backups for 1:00 am every day, then the backup will happen at 1:00 am the first day, and Net-Archive will then quit and not restart itself. You'll need to either

restart your machine if Net-Archive is in your list of startup items, or restart Net-Archive by hand. If you turn your machine off or restart it once per day, then everything will work fine, as long as you only enable backups once per day.

4.1.6 About filenames

There are many more characters in the international alphabets than the 128 printable characters and special characters in the ASCII character set commonly used in personal computers. The emerging Unicode character set supports up to 16,384 different characters. Not all display devices are capable of supporting the full Unicode character set, and so to be on the safe side, some of the more common special Unicode characters are translated into sequences of ASCII characters. For example, a space in a filename appears as the 3-character ASCII sequence “%20”. A slash (/) is represented as “%2F”, and there are other Unicode-to-ASCII mappings as well.

Your client program knows the capabilities of your display device and only uses the ASCII sequence equivalent of Unicode if it has to. The server does not know your display characteristics, and so it uses the ASCII sequences. Your client converts messages sent from the server into Unicode when it can, but in some situations, the ASCII sequences are used.

If all of this sounds confusing, don't worry too much about it. You can use either character representation and everything will work fine. The kind of situation where this dual-representation is more visible is when a file is uploaded from a Mac or a PC with a special character in the filename, and the file is then downloaded to a different machine that does not support Unicode.

4.1.7 My machine crashed in the middle of a transfer.

If your computer crashes, or you lose your connection in the middle of a transfer, then don't panic. All of your local files as well as the archive are still safe (unless of course, the crash is due to a permanent disk failure on your machine, but that's where Net-Archive can help!) You can continue the backup or restore operation after your machine is up again, and the right things will happen. The file that was being transferred will not be damaged or lost as a result of the crash.

In Net-Archive Client v1.0, the recovery mechanism is overly pessimistic. If a file is only partially uploaded at the time of a crash, then the backup picks up again at the beginning of the file. There is actually enough information available to safely continue the backup in the middle of the file. This partial recovery mechanism will be implemented in a future release of Net-Archive.

4.1.8 My machine was stolen with the keys.

Your files are securely stored at your Net-Archive Server site, and so you can restore your files to another machine if your computer is ever stolen. But what happens if a

thief uses your copy of Net-Archive Client to connect to the server and attack your files?

Well, that *could* happen. It's just as if someone steals your wallet and the keys to your home: the thief now knows where you live, and has the means to enter your home. Although Miletus Research can restore any of your deleted files from our own backups of your archives, that won't help you if you don't even know that a file was maliciously deleted or modified.

The best protection against a malicious attack is to make sure that your computer does not get stolen! Barring that, your next best defense is to avoid saving your settings while the password and encryption key fields are filled in with valid entries, so that they are not permanently recorded in your machine. A good second level defense is to contact Miletus Research (if you use our server constellation) and ask us to change your password if your machine is stolen – but be prepared to convince us that you are who you say you are!

Typically, a thief only wants your computer, and has no interest in your archived data (after all, we do keep records on who connects to the archive and from where – an electronic paper trail exists that reduces the confidence of anonymity for the thief.) So for this scenario, suppose that your computer is gone, and that you have encrypted data but you forgot your encryption keys.

This is a generally unpleasant and painful situation. However, all is not lost: it is possible to recover your lost encryption keys from your encrypted data if you know the exact contents of one of your files, and if you involve the encryption staff at Miletus Research. Yes, it *is* possible to break the encryption code (*all* encryption codes are breakable), but it takes cooperating “insiders” at your organization and ours, and a lot of patience and technical know-how to make this work. Again, be very prepared to convince us that you really are who you say that you are!

4.1.9 On a Unix system, I get the error message “command not found.”

You need to update your PATH variable to include the path to `net-archive_client` or `net-archive_server`. In a shell script running under `cron`, you should specify the full pathname for the executable as well as any arguments.

4.1.10 What happens when I exceed my quota?

We will tell you when you have exceeded your quota, and will give you the option of reducing your storage or purchasing additional space in the server archive.

4.1.11 What happens if I change a file while it is being backed up?

The backup process starts by creating a list of files that need to be backed up based on their modification times. That list is used for the remainder of the backup session, even if files on the list are deleted by other programs, or new files are created that

should be placed onto the list. Net-Archive Client will recognize the missing file situation and will simply print a warning message.

If a file on the backup list is modified while it is being backed up, however, then it is possible that what actually gets backed up is part of the original file and part of the changed file, which is a dangerous situation because you will no longer have a valid backup copy of the file in the archive. The solution is to avoid using files that are in the process of being backed up, or to invoke Net-Archive Client again when you have finished using the files to ensure that a valid copy of the changed file is in the archive. (Your local copy of the file will be OK regardless of conflicts because Net-Archive Client only reads your files during backups; it doesn't make changes to them.)

4.1.12 Net-Archive Client doesn't recognize a new filename as being new.

On Windows and MacOS machines, upper and lower case file extensions compare equally. For example, "tmp.gif" and "tmp.GIF" map to the same file. Net-Archive Client, however, distinguishes filenames based on case sensitivity, but only on operating systems that can make the distinction. Thus, if you back up `tmp.gif`, and then change its name to `tmp.GIF` on your PC or Macintosh, then it will not be backed up a second time unless the contents of the file are modified.

4.1.13 The Get Time option is way off.

The time settings on your computer are off. Check to make sure that your setting for Daylight Savings Time matches what it really is.

4.1.14 Why are colors wrong on my PC?

You may need to download a newer version of Microsoft Explorer from <http://www.microsoft.com>, which will update your DirectX library along the way.

4.1.15 I can't edit the password (or key) field on SunOS/Solaris.

The password and key fields are displayed using asterisks (*) for security purposes. On the Solaris (SunOS) platform, if the password field is selected (some or all of the asterisks are highlighted) then it cannot be changed. The solution is to click on any part of the field without sweeping across it, and then you will be able to edit the field normally.

4.1.16 On the Macintosh, I double-clicked on the Net-Archive Client icon but I got: "An error occurred while loading a shared library."

Solution: You need to install MRJ 2.0. Use your Net-Archive CD-ROM to install MRJ 2.0 by double-clicking on the Net-Archive Installer icon and selecting the MRJ 2.0 installation – there is no need to reinstall Net-Archive Client.

4.1.17 How do I uninstall Net-Archive Client?

On a PC, if installation was done normally, then there will be a "Remove Net-Archive Client v1.0" icon in the Net-Archive folder in the START menu. Select

this icon, which will uninstall Net-Archive Client. If there are any problems uninstalling Net-Archive Client, then you can simply drag the Net-Archive v1.0 installation folder and the C:\Windows\Start Menu\Programs\Net-Archive v1.0 folder to the Recycle Bin.

On a Macintosh, simply drag the Net-Archive v1.0 installation folder to the Trash icon.

On SunOS /Solaris, use the Unix “rm” command to remove the installation folder, as in % rm -r net-archive_client1.0.

4.1.18 On Win95/NT, I try to uninstall Net-Archive Client, and I get a message “Uninstall partially successful.”

This can happen if you restore files into the same directory as the Net-Archive Client application. The uninstaller is only aware of the files that it installed, and so it deletes those files only. When it finally tries to delete the installation directory (folder), it fails because there are restored files in it that have not been removed. The solution is simply to drag the installation directory to the Recycle bin.

4.1.19 On Win95/NT, I get the startup banner, but nothing after that.

This is an anomaly with the Java runtime environment for that platform. You will need to use Ctrl + Alt + Delete to kill the process named “jreaw” and start again.

4.1.20 On Win95/NT, I get an “Illegal operation” error message when I close Net-Archive.

This is a problem with internal cleanup operations as the application is exiting. Just ignore the error message. The archive and all of your data will be OK. This error message will be caught and handled more gracefully in a future release.

4.1.21 On a Macintosh, windows are not fully redrawn.

This is a timing problem with the Java virtual machine and slow disk access on the Macintosh that can be solved by increasing the amount of memory allocated to Net-Archive. (See the next FAQ for instructions on how to increase the preferred memory size.) A solution is to disable virtual memory and to not allow the disks to sleep. You can force the window to be redrawn by moving it outside of the viewing area and then bringing it back into the viewing area, by dragging the window bar at the top of the window.

4.1.22 On a Macintosh, Net-Archive freezes whenever I work with a lot of files.

Solution: Increase the preferred memory size of Net-Archive:

- Quit out of Net-Archive Client if it is open.
- Click just once on the Net-Archive Client icon (don’t double-click on it.)

- Choose “Get Info” from the File menu.
- Increase the number in the “Preferred Size” box. We had to go as high as 40,000 KB to handle a restore list of 2400 files.

4.1.23 I backed up my files from a PC (or a Mac, or Unix). Can I restore them to a Mac (or a PC or UNIX)?

Yes, you can backup from any of these three platforms and restore to any of them.

4.1.24 On Solaris, net-archive produces the error message “java.lang.NoClassDefFoundError” in the console window.

The amount of memory allocated to the Java runtime environment (in which `net-archive` executes) is not enough. You will have to kill `net-archive` from the console window, increase the amount of memory allocated inside of the `bin/jre` file in the `net-archive` installation directory by increasing the argument to `mx`, and then restarting `net-archive`.

4.1.25 Why are some operations so slow?

Depending on your settings, your computing environment, your network, and the volume of information that you back up, there are various operations that will dominate the response time of Net-Archive Client. Here are a few tips:

- Are you on a 680x0 Macintosh or a pre-Pentium PC? The older 680x0 based Macintoshes and 'x86 based PC's are much slower than the PowerPC Macintoshes and Pentium based PC's.
- Are you backing up too much? Check your backup list in the Backup Window. You may be backing up a lot more than you need to back up.
- Is your Internet service provider getting your network traffic through? Not all ISP's give you good Internet access beyond their own servers.
- The address book may be getting too big. You may want to reduce the size of your backup list, or simply delete the address book and let Net-Archive rebuild it. This will cause previously backed up files to be backed up again, but the address book will be smaller if some of the old files are no longer on your system (though they will still be on the server unless you explicitly delete them or run the CLEAN operation.) A faster search scheme will be used in a future release so that large backup lists are handled better on slower machines.
- Optimize the address book (in the File... menu). The address book, which keeps track of which files have been backed up and when, also keeps track of the frequency count for how many times a file is backed up. The Optimize operation sorts the address book so that the most frequently used files appear first in the list, and it also removes rarely referenced files so that Net-Archive Client will know more quickly if a

file is not in the list. Optimize takes a while (several minutes for large file lists) so it is only invoked after a backup process completes.

- Do not use compression. (Compression is not enabled in v1.0) The hardware compression used in a modem is much faster than any software compression scheme, and using both compression methods in conjunction will not save you any time. The main motivation for using software compression on file backups is to reduce your storage needs on the server. With the dropping price of hard disk storage (the cost of hard disk storage drops by about a factor of 2 every 18 months) it is better to just wait until you need more storage on the server, because by then, you can probably get twice as much storage for the same price.

4.2 CONTACTING US

If you need to contact us for technical support, sales, licensing issues, or anything else, electronic communication works the best (especially outside of regular business hours.) You can contact our technical support staff by sending an email message to:

`support@miletus.com`

You can visit our Web page at:

`http://www.miletus.com`

Our mailing address is:

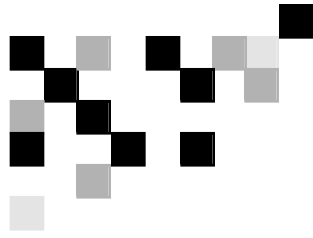
Miletus Research
P.O Box 1325
Jackson, NJ 08527-1374 (USA)

Our address for deliveries is:

Miletus Research / Davison Computer Services
120 Jersey Avenue, Suite #301
New Brunswick, NJ 08906-0026 (USA)

Our telephone numbers are:

732-905-0582 (Phone - General)
732-905-3058 (Fax - General)
888-901-7583 (Phone - Orders and inquiries)
888-383-7424 (Fax - Orders and inquiries)



IDLE TIME ON A NETWORK CONNECTION

A

A.1 BACKGROUND

How much idle time is available for backups using a dialup modem? Measurements of dialup modem traffic were taken over a 4-day period for 31 terminal servers on the Rutgers University-New Brunswick campuses. The purpose of taking the measurements is to study the asymmetries in dialup usage at the boundary of the Internet, which serves as a reference point in determining available uplink bandwidth.

The measurements are static in the sense that we simply probed the terminal servers for information that is recorded on-the-fly with periodic updates. We did not instrument the lines or monitor the actual data as it was transmitted.

We found that 9% of the network traffic flows upstream from the end user to the Internet, which means that 91% of the available uplink bandwidth from the end user to the Internet is unused.

A.1.1 Introduction

Several components in a local area network (LAN) or a wide area network (WAN) maintain statistics on traffic through the component interfaces. These statistics are maintained as variables in a management information base (MIB). The MIB can be queried using the simple network management protocol (SNMP). In the measurements reported here, we use SNMP to query the MIB variables of 31 terminal servers at Rutgers University-New Brunswick over the closest link to the user (the so-called “last mile” of the Internet).

The older version 0 of the SNMP protocol (referred to as SNMPv1) is used in this study because the newer version 1 (SNMPv2) is not

supported by at least some of the components in the reference network.

We know from other studies that there is an asymmetry in traffic flows over a dialup modem connection. In general, a greater flow of traffic moves downstream to the end user than on the upstream to the network. Intuitively this makes sense, as it only takes a few keystrokes to cause an entire page to be downloaded, but the degree of asymmetry is complicated by protocols, compression, and other factors.

A.1.2 System Configuration

The traffic samples were taken over 31 terminal servers connected to the Rutgers University RU-Net campus backbone. There are more terminal servers than are listed below, but this subset was chosen because the terminals respond to public SNMP queries. The system configuration over which the measurements were taken thus does not include measurements of all of the dialup traffic into and out of the Rutgers network.

The domain name system (DNS) information for the terminal servers is shown below. This information can be used by anyone outside of the `rutgers.edu` domain:

TERMINAL SERVER NAME	IP ADDRESS
New Brunswick	

coretop.rutgers.edu	128.6.171.6
rooftop.rutgers.edu	128.6.171.7
blacktop.rutgers.edu	128.6.171.8
tippytop.rutgers.edu	128.6.171.9
branford.rutgers.edu	128.6.225.6
quincy.rutgers.edu	128.6.225.7
dizzy.rutgers.edu	128.6.225.8
calloway.rutgers.edu	128.6.225.9
vaughn.rutgers.edu	128.6.225.10
blakey.rutgers.edu	128.6.225.250
waller-a.rutgers.edu	128.6.44.54
waller-b.rutgers.edu	128.6.44.71
waller-c.rutgers.edu	128.6.44.88
parker-a.rutgers.edu	128.6.44.3
parker-b.rutgers.edu	128.6.44.20
parker-c.rutgers.edu	128.6.44.37
mingus-a.rutgers.edu	128.6.44.105
mingus-b.rutgers.edu	128.6.44.122
metheney.rutgers.edu	128.6.44.139 (Not SNMP queriable.)
monk.rutgers.edu	128.6.225.3 (Not SNMP queriable.)
Newark:	

erbium.rutgers.edu	128.6.53.89
iridium.rutgers.edu	128.6.53.90

Each terminal server supports 16 dialup ports, which gives an upper bound of $31 \times 16 = 496$ dialup ports that can be measured. Not all of these ports have working modems connected to them, nor are all of the ports necessarily used if traffic is such that some ports on a particular server are not needed.

In general, dialup lines are clustered into “hunt groups”, in which a single dialup number is used by all dialup users, and if the line is busy, the next line in the hunt group is accessed in a predefined order. Some of the hunt groups span more than one terminal server.

A.1.3 Summary of Measurements

Of the 496 dialup ports, only 187 show traffic that is reported by SNMP. This means that 187 lines carried protocol based traffic, typically using a point-to-point protocol such as SLIP, CSLIP, or PPP. There is a significant amount of unobserved traffic that SNMP does not capture on these terminal servers, such as dialup connections that treat the client machine as a “dumb terminal” that does not handle IP or other protocols, routing protocol traffic through the Ethernet interface, and SNMP queries generated by the study. Since the goal of the study is to observe the differences in upstream and downstream Internet traffic, this “dark traffic” is inconsequential to the study.

In terms of octet (byte) counts, we find that upstream dialup traffic accounts for 9% of the total traffic over the dialup lines, and that upstream dialup traffic accounts for 51% of the packets transmitted over the dialup lines.

The average upstream packet size is 49 bytes, and the average packet size from the terminal server to the network is 77 bytes. The average downstream packet to the user is 337 bytes, and the average packet size from the network to the terminal server is 342 bytes.

A.1.4 Discussion

Differences in traffic to/from terminal servers versus traffic to/from the dialup lines result from: (1) error packets, (2) buffer overflows, (3) SNMP traffic that terminates or originates in the terminal server, (4) Ethernet broadcast/multicast traffic that terminates in the terminal servers, (5) routing protocol traffic, (6) IEEE 802.3 translation which increases the upstream packet sizes, and (7) CSLIP/PPP header decompression.

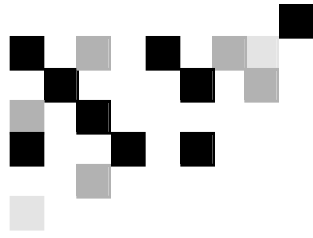
A.1.5 Conclusion

Internet dialup traffic is asymmetric at the network boundary. Only 9% of the uplink bandwidth from the end-user to the Internet is currently utilized, which means that 91% of the uplink bandwidth is available for other uses, such as Net-Archive backups.

A.1.6 References

Stevens, W. R., "TCP/IP Illustrated Volume 1: The Protocols," Addison-Wesley, Chapter 25, (1994).

“Cisco Management Information Base (MIB) User Quick Reference,” available at http://www.cisco.com/univ-src/3.8/doc/software/11_0/mib/mtext.htm.



DOWN THE ROAD

B

B.1 ENHANCEMENTS FOR FUTURE RELEASES

At Miletus Research, we are constantly striving to improve our products to meet your needs. Here are just a few of the improvements we are working on for future releases of Net-Archive:

- Servers for Win-95/NT and Macintosh platforms;
- Exportable versions of Net-Archive Client and Net-Archive Server;
- Speed improvements and better handling of large archives (tens of thousands of files per user);
- Compression;
- Partial recovery. After losing a connection, interrupted transfers can continue in the middle of the interrupted file rather than at the beginning of the file;
- Server-Sync technology for high availability (see next section for details.)

B.2 AN OVERVIEW OF SERVER-SYNC

The basic principle behind Miletus Research's Server-Sync is to guarantee high availability by dividing an archive into segments, applying a transformation to the segments producing a new "redundant" segment, and then distributing all of the segments among the constellation servers.

Unlike other approaches that copy full mirror images of an archive across multiple sites, only a fraction of an archive is replicated with

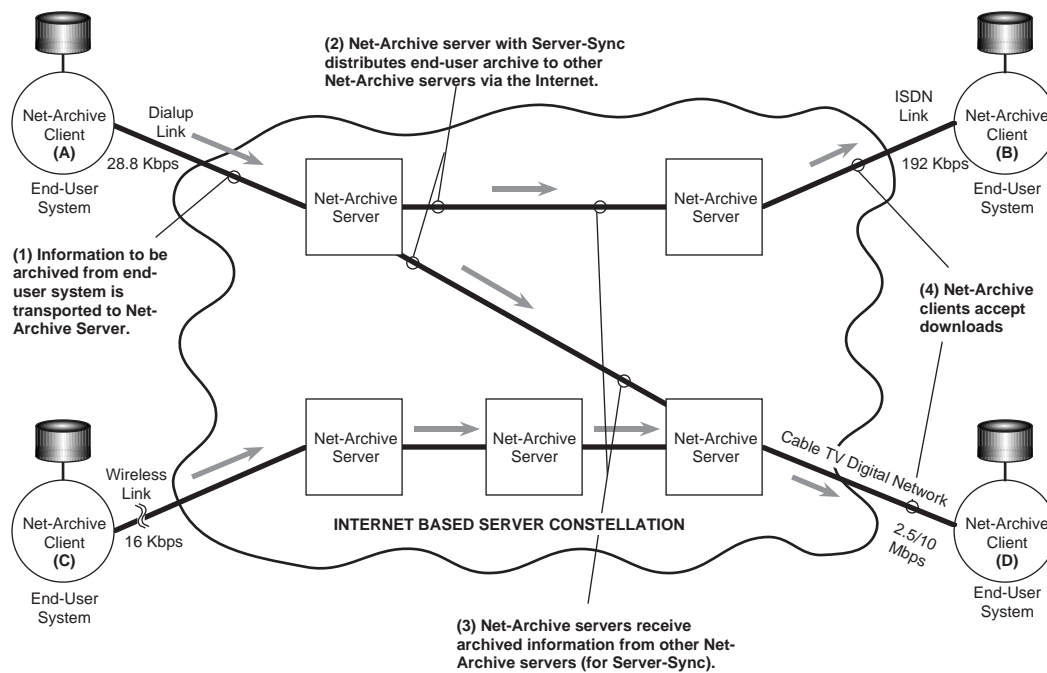


Figure B-1: Overview of Net-Archive using Server-Sync.

fractional mirroring, yet the full archive is always accessible even with 25% to 75% of the systems unavailable. This enables faster synchronization and makes the most out of the available bandwidth.

In Figure B-1, a Net-Archive client (A) uploads an archive to a Net-Archive server over a dialup link at point (1). For server constellations running Server-Sync, the Net-Archive server that accepts uploads at point (1) negotiates connections with other Net-Archive servers that are members of the same constellation and distributes the archive via the Internet or a private network at points labeled (2). Net-Archive servers then accept archived information from other Net-Archive servers at points labeled (3), which serve as the collective repository for the archive. The reverse actions take place when an archive or a portion of an archive is retrieved, although not necessarily over the same paths, if the receiving client is in a different location than the sending client, as shown at point (4).

The approach to providing secure, robust, distributed storage is to decompose the archive into segments that are distributed to a constellation of accepting sites, with the locations of the constellation members recorded in an address book that is also stored in a distributed manner. In this way, no single repository can use codebreaking methods to reconstruct the whole, and there is no single “weak link” in providing high availability. Forward error correction (FEC) is applied so that a number of individual

repositories can be unavailable while still being able to reconstruct the archive. Highly available systems do not need to be slow or expensive, and the widespread distribution of FEC encoded segments may actually improve access speed by reducing bandwidth problems at the repositories.

All highly available systems rely on some form of redundancy to compensate for failures within the system. A simple (and wasteful) approach, which is not used by Server-Sync, is to simply copy the entire archive to multiple sites in a so-called “mirrored” approach. If we explore this a bit farther, we need to consider: How many mirror sites are enough? It depends on the level of reliability needed, and the expectation of failure for the individual systems or a critical portion of the Internet. A bare minimum is three mirror sites, so that one site can be taken out of service for maintenance while still providing some level of redundancy. This addresses failures of individual systems in a minimal way, but does not adequately address network failures, since a single network failure can affect a disproportionately large number of systems.

The Internet as a whole is too large and heterogeneous for the entire Internet to collapse, but local network outages occur frequently. The Internet is a complex distributed system with no centralized control, which is both a strength and a weakness. The strength is that there is no single “Achille’s heal” that can bring down the entire Internet. The weakness is that localized network outages may be caused by network traffic that can only be observed and properly managed with centralized control.

Given the often unpredictable availability of any localized portion of the Internet, *three mirror sites are not nearly enough*. Are 10 mirror sites enough? If they are geographically scattered and connected through different service providers, the answer is “Very likely.”

The problem of assembling a constellation of 10 systems using *conventional* mirroring has to do with cost: For every megabyte of information that a user uploads to an archive, 10 megabytes are consumed by the constellation due to the replication caused by mirroring. This is an unacceptable overhead, yet if we reduce the replication overhead to a factor of 2 or 3, which is more acceptable, the degree of redundancy is not sufficient enough to ensure high availability in the Internet environment.

As a solution to this problem, Server-Sync applies a simple forward error correction scheme normally used in communication applications or storage applications that incurs only a small overhead (a factor of 2 or 3) while still ensuring high availability by using a large constellation of systems.

The basic principle is to divide an archive into segments, apply a transformation to the pieces that produces a new “redundant” segment, and then distribute the segments

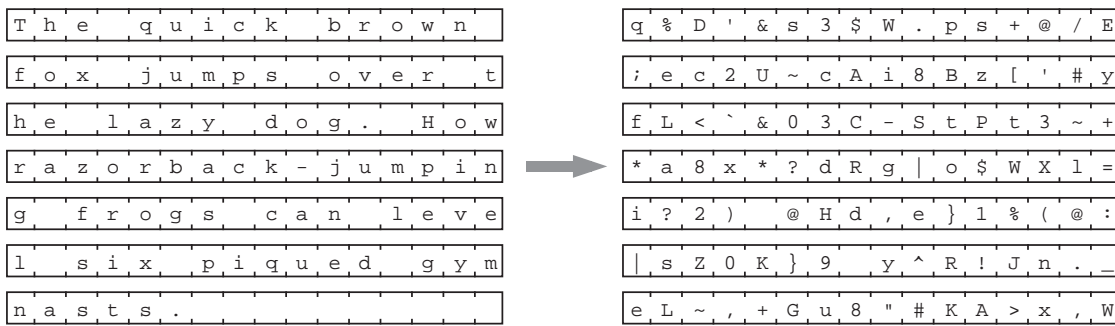


Figure B-2: *A text sequence is encrypted and decomposed into shreds.*

among the constellation. As an example, consider an archive that contains a single piece of information, a telephone number: 905-0582. We break the telephone number into 7 segments, with one digit per segment: 9, 0, 5, 0, 5, 8, 2. We then apply a simple addition operation over the digits, and retain only the rightmost digit of the result (the “modulus” in base 10, also known as mod_{10}): $9 + 0 + 5 + 0 + 5 + 8 + 2 = 29$, with a modulus of 9. We then store the segments 9, 0, 5, 0, 5, 8, 2, 9 on eight different systems.

We can retrieve the original phone number using any 7 of the 8 systems, because we know that there is a modulus relationship among the segments. For example suppose that the system that contains the 8 is unavailable. After retrieving the digits from the other systems, we have the relationship: $\text{mod}_{10}(9+0+5+0+5+X+2) = 9$ for which the only possible single-digit solution is $X = 8$.

Only one system can be unavailable with this particular example, but the overhead is only 1/7. For higher reliability, we extend the approach and apply a redundancy of 2 or 3, which supports full availability with from 25% to 75% of the systems within the constellation unavailable, the exact number depending on how the failures are clustered.

Watch <http://www.miletus.com> for Server-Sync availability.