esXpress v3.1

Restoration and Disaster Recovery Manual

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esXpress U.S. Patent Pending

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Introduction

Overview

By using virtual machines, your entire server is encapsulated within a VMDK or virtual machine disk file. While your virtual machines may look and feel like real servers, they are in fact just files. They are no different from a word processing document, spreadsheet or a picture. Simply copy the file and you have copied the server. esXpress provides you 100% recoverable copies of these files.

esXpress backups are portable with the software required to restore each virtual machine built into the backup file itself. The archives are self executable. In an emergency, you only need your backup files, not our software. esXpress backups are portable and can be extracted on VMware GSX and VMware Server as well as ESX 2.x and VI3 platforms. Optionally, esXpress can secure your backups with 256-bit encryption. Don't suffer the embarrassment of public disclosure if a backup tape is lost.

esXpress simplifies the complexities of VMware backup and recovery while ensuring your business is always protected.

esXpress Restoration Features

- Multiple backup targets. Your backups can be accessed via local VMFS storage or remote FTP.
- The **ONLY** 256 Bit Encrypted ESX VMDK Backups. Each backup is **optionally** encrypted and can only be restored with the proper- password. 100% safe to transport off premises.
- Menu driven, no scripting required.
- Real-time monitoring and statistics
- Ability to cancel restores
- Restore your entire environment or a single server to almost any point in time
- Self-extracting restore requires no client software to get your backups up and running
- Disaster Recovery - Restore your entire business in **hours** not days.
- Simple "One to Many" replication
- The only product that properly restores onto the VMFS files system resulting in none to minimal fragmentation
- Restore your backups to VMware Server/GSX/Workstation on Windows or Linux
- Multiple background restore jobs

Flexibility Under Any Circumstance

Probably the most important feature of any backup product is the ability to restore a backup. While all products can restore a backup under ideal conditions, it is the ability to restore under any condition that differentiates a backup tool from a disaster recovery tool.

esXpress provides for the maximum flexibility and choices when restoring virtual machines. For example you can restore to an ESX host in your data-center or to your Windows laptop running VMware Server.

There will be many times when it will be necessary to restore one or more virtual machines. Most of these will be in the course of daily business, such as restoring a virtual machine in its entirety, or just a single file.

There may also be a time when you experience a catastrophic interruption like fire or natural disaster, or something less dramatic, like simply having to evacuate your building due to a derailed rail car or a gas leak in the building next door. Either way, your business needs to continue to operate and with the esXpress Auto/Mass restore feature, your entire virtual environment can be restored and running in hours.

Virtual machines backups contain everything that makes up a virtual machine, the operating system, the data and applications that make the data meaningful. While this is a tremendous convenience, unless your backups are encrypted, it is also on of the most dangerous conveniences.

Just as it is easy to share with a coworker, virtual machines allow anyone who has your backups to restore them and simply “turn them on”. esXpress compensates for this danger by adding optional government standard AES-256 encryption, making your backups safe to transport across the town or across the Internet.

No matter what the reason or circumstances, whether restoring a single virtual machine or hundreds, esXpress is designed to assist the administrator as quickly and reliably as possible.

FULL and DELTA Backup Archives Explained

When run, esXpress will create (2) types of archives, FULL and DELTA. A FULL archive is created either, the first time a virtual machine is backed up by esXpress, the virtual machine or host was scheduled to run FULLS, or the DELTA threshold has been exceeded.

A FULL archive is nothing more than either a GZIP or LZOP compressed archive of a VMDK file, optionally encrypted with GPG. This archive can be restored on any Windows, Linux or ESX platform using both free open source utilities like LZOP and a paid commercial product like WinZip. You DO NOT need the esXpress software to restore a FULL archive created with esXpress.

If the conditions for making a FULL have not been met, a DELTA archive is created by default. A DELTA is a true block level differential of the last FULL backup. Only (1) FULL and (1) DELTA file are required to restore any virtual machine.

DELTA archives also contain the virtual machine configuration (.vmx) and non-volatile RAM (.NVRAM) files. When esXpress creates a FULL archive, it will also create an empty DELTA archive. Empty meaning it will contain no delta blocks, but it will contain the .vmx and .nvram necessary to rebuild the entire virtual machine.

So, assume for example that your backup schedule is creating a FULL archive on Sunday, and DELTA archives Monday through Saturday. To restore to Thursday's backup would require Sunday's FULL and Thursday's DELTA.

Also, esXpress maintains an index map of the FULL backup, meaning no access to the original FULL archive is required in order to create a DELTA archive. This is both efficient and allows you to purge archives to tape.

Delta vs. Full Restore

When restoring backups, it is always preferable to restore a DELTA backup instead of a FULL backup. While restoring a FULL backup is faster than restoring a DELTA, DELTA restore have advantages over the FULL.

If you are restoring a FULL backup, it is simply restored as a plain file as it is uncompressed. Because the FULL is simply a gzip or lzop archive, there is no way to know the actual uncompress VMDK size. The system will therefore but write out the new file one block at a time, same as the copy or tar command would. Because the VMDK is not pre-allocated, restoring multiple virtual machines to the same VMFS file system simultaneously would effectively interleave the two VMDKs causing severe fragmentation and definitely affect the performance of the virtual machine.

When esXpress restores a DELTA archive, it knows the exact size of the VMDK, as this information is stored in the DELTA archive. This allows esXpress to create the VMDK file on the VMFS first, then import the backup archive into that pre-allocated VMDK file. This is the proper way to write to the VMFS. Because of this import, you can restore multiple VMDK files to the same VMFS at the same time with no risk of fragmentation.

When esXpress creates a FULL archive, it always creates an empty DELTA archive also. This DELTA backup contains the metadata information about the backup including the original VMDK file sizes, along with VMX file and the index maps. Restoring a FULL using the empty DELTA will allow you to perform multiple FULL restorations against the same VMFS with no risk of interleaving.

When esXpress DELTA backups are restored, the restored file is checked, block by

block on restoration against the index map. If there are any problems, like insufficient free space, or a checksum error, the restoration will be aborted. If you were to lose a FULL archive, and try to rename a previous FULL to replace it, it will not succeed. The checksums will not match the index map and the restore process will be aborted.

Portable Self Extracting Encrypted Delta Block Backups Explained

While the technology has a complicated name, the concept is a simple one; create an archive file that is completely portable between all VMware platforms and operating systems while maintaining security.

This self extracting archive is what differentiates esXpress from other products and why it is truly a disaster recovery tool as much as a daily backup utility. Archives created with esXpress are actually executable programs containing all the logic necessary to restore and register a virtual machine without the need for the esXpress software or license key.

esXpress Delta archives contain not only the virtual machine disk files (VMDKs), but also the configuration and NVRAM files, everything you need to completely restore a virtual machine. This allows for effortless restorations regardless of circumstance or platform.

It also allows for easily and securely sharing virtual machines with co-workers who might not have access to the esXpress software of VMware Infrastructure 3 platform.

Restorations: Three Different Types

Flexibility, business demands it. Misfortune happens and you are tasked to react quickly. For that reason we have designed esXpress with multiple ways to perform restores to handle most any circumstance or situation.

- Command Line
- Console Menu
- Automatic Mass Restore

Command line restorations are ideal for disaster recover where you may not have the resources or time necessary to build an environment capable of point and click restore. It is also great for those that are comfortable with the Linux/ESX command line.

Console menu restorations allow you to restore virtual machines using a text menu interface. This is great for when you are in the data-center or physically logged on to the host. The console menu is also available via any SSH connection (via PUTTY for

example). This option requires minimal bandwidth and can performed remotely even across dial-up connections.

Automatic Mass Restores are repeated, scheduled restorations. This option is for use in a disaster recovery situation where the administrator needs to restore dozens to hundreds of virtual machines with little or no user interaction.

This option is also great for use at a co-location. esXpress can replicate your environment to the co-location allowing for a complete warm standby datacenter.

File Level Restorations: Two Different Types

With esXpress there are 2 different types for doing file level restores. The primary method would be to run the esXpress File Level Backup Feature and then perform File Level Restores from those separate backup archives. If you are running just vmdk backups then it is also possible to do File Level Restores although esXpress does not have any specific built in text menu or gui functions for it.

- File Level Backups Restores
- File Level Restores from VMDK backups

File Level Backups Restores

With esXpress v3.1 file level backups it is simply creating a gzip or tgz file on a network share. Because of that the backups can be simply restored by the end users and therefore there isn't any built in esXpress restore feature at this time.

What we recommend is that you identify the correct dated FLB backup and use whatever tools you are comfortable with to uncompress the file (for example WinZip). Then extract the needed file or files from that archive and copy them to you associated virtual machine.

File Level Restores from VMDK Backups

For file level restores with esXpress from vmdk backups you will need to restore the vmdk image and mount that vmdk to restore the file or files from it. There are a couple of different options we recommend,

On your backup server (if backing up to FTP for example), install VMware Server on that server, restore the VMDK on the backup server, mount it in a helper VM and extract the files. (If using Windows, you need CYGWIN installed to restore the delta backups).

Or on a DEV ESX host, restore the VMDK there, boot it up in host only mode, or again mount the VMDK in another VM and extract the files from there.

It is planned that in the next generation of product of esXpress to be able to pull files directly from the esXpress Delta or Full image vmdk backups.

Other Restore Considerations

If restoring to VMware Server or GSX on Windows you will need CYGWIN. See section "CYGWIN Installation and Configuration Procedures". Full instructions for doing this install can be found on the documentation page of esXpress web site,
'Restoring esXpress Delta Backups under Windows using Cygwin'
http://www.esxpress.com/cygwin/index.php

If restoring encrypted archives you will need GPG 1.0.6 RPMs installed. This is required for all restoration platforms including ESX, Linux and Windows. See the "esXpress v3 Installation and Configuration Guide" for instructions.

Getting Started

Planning

esXpress can restore the archived data over the network, from attached storage (SAN, iSCSI, NFS, local), or in the case of a DELTA restore, from both media simultaneously.

If restoring esXpress backup archives from a network server, make sure you know the following about the server:

- Name/IP Address of FTP/SSH Server
- Port
- User ID
- Password
- Path to Backup Folder
- The FTP/SSH user must have complete access to the share, it must be able to create folders and files, rename and delete files.

As a security precaution, you must have root access to the VMware host to install and execute the esXpress software.

*NOTE: FTP Users

If your backups are stored on either a Windows Server product running IIS, or a Windows based hardware appliance, note the Microsoft's FTP implementation is severely flawed and unreliable when working with files larger than 4GB in size. Backups made via a Microsoft IIS server may not be restorable.

We strongly advise using a commercial quality FTP package. We have found Filezilla to work extremely well even under the most demanding conditions.

Installing the Software

From CDROM

Please see the esXpress v3 Installation Guide for installation and configuration instructions.

Installing Encryption

If you want to use encryption with your esXpress backups, then you need to install the **gnupg-1.0.6-3.i386.rpm** from the Redhat 7.2, cd 1 or is available on your personal esXpress download page. This GNU GPG package is binary compatible with VMware ESX 2.x and Virtual Infrastructure 3.

Please see the esXpress v3 Installation Guide for installation and configuration instructions.

Upgrading the Software

Please see the esXpress v3 Installation Guide for upgrade instructions.

Uninstalling the Software

Please see the esXpress v3 Installation Guide for removal instructions.

Restoring A Virtual Machine

Restoration of a Virtual Machine to a VMware ESX Host via the Command Line

With esXpress you don't need to have the software installed on your host to restore your Virtual Machine's vmdk files. For example, in a DR scenario you may be recovering to a new host without esXpress installed on it. It is important to note that esXpress is a vmdk restoration product, so each vmdk is restored separately along with optionally the vmx. In a DR scenario we recommend pre-creating your Virtual Machine from the VI3 client first and then start the esXpress restores. In this way the vmx is setup correctly and the correct folders to restore the vmdk into already exist.

Full Backup Archives – 2 Methods :

Method 1:

esXpress Full Backup archives are nothing more the compressed (gzip or lzop) vmdk file. To restore this archive without the esXpress software you would just uncompress the file.

Example:

-rw-r--r-- 1 root root 5368709120 Apr 29 13:32 00-RedHat_VM1.vmdk.gz-080429-1134.phd

This is a gzip Full backup archive you to decompress it you would do the following, note the file ends in a .phd suffix so you need the –S option for gzip.

gzip -d -S phd 00-RedHat_VM1.vmdk.gz-080429-1134.phd

Note: The unzipped vmdk file you have just restored in this method is actually the flat file. You still need to create the stub file to be able to use this archive. There are a couple of different methods you can use.

- you can pre-create the VM in the VI3 client with an empty disk that is the same size as the restore vmdk. Then overlay the –flat file with the restored vmdk.
- Use the esXpress stub generator program to create the stub file http://www.esxpress.com/tools/wrapgen.php

If you choose to manually copy the file to correct folder make sure you copy it as the correct name (ex : RedHat_VM1-flat.vmdk). Be careful when manually copying files, make sure the new VM is powered off and you are not overlaying the wrong file.

Method 2: (Recommended Method)

Every time esXpress creates a Full Backup it also creates an empty Delta archive. You can use this empty delta archive to restore your Full Backup. This method enables the built in menu within the delta and allows for less manual steps. It also will verify the blocks in the backup archive. This process is described under the Delta Backup Archives section below..

Example directory listing showing empty delta backup with Full

```
drwxr-xr-x  15  ftp   ftp          4096  Apr 29 11:41 ..
-rw-r--r--   1  ftp   ftp       2097171  Apr 29 11:54 00-RedHat_VM1.vmdk.delta-2008.04.29-1134-
080429-1134.phd
-rw-r--r--   1  ftp   ftp    1000739843  Apr 29 11:54 00-RedHat_VM1.vmdk.gz-080429-1134.phd
```

To restore the Full backup in the example above you could run:

sh 00-RedHat_VM1.vmdk.delta-2008-04.29-1134-080429-1134.phd

Delta Backup Archives

All esXpress Delta backups are self extracting executable Files. To restore the Delta backup archive you would shell the backup.

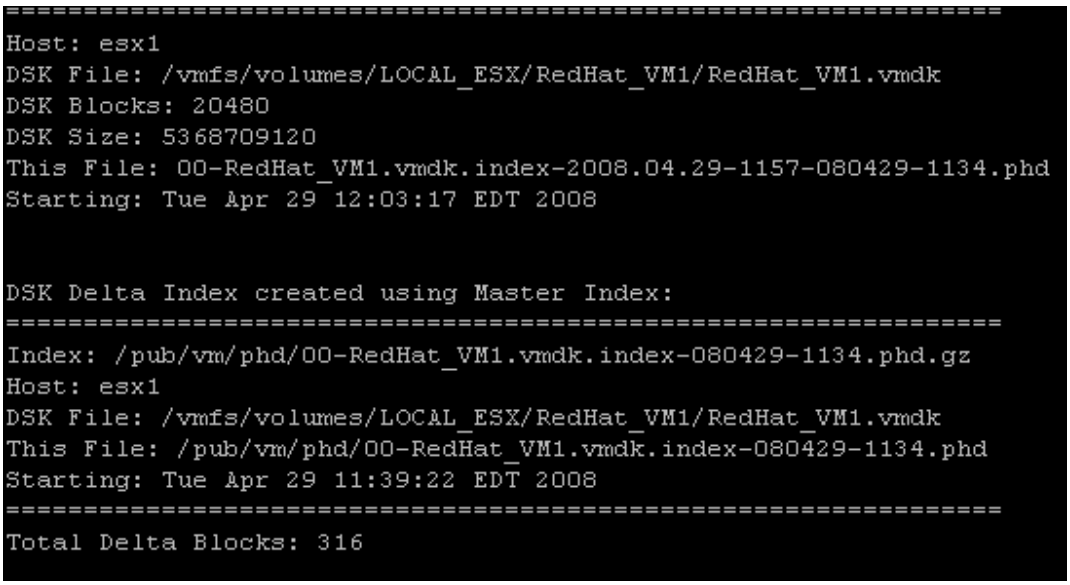
Example:

sh 00-RedHat_VM1.vmdk.delta-2008.04.29-1157-080429-1134.phd

This will launch a mini esXpress restore Menu which will walk you through the restore process.

The top section of the menu shows the various information regarding the Delta archive including, the host it was initiated from, the vmdk file, and the total Delta Blocks. (*Figure sh-1*).

Figure sh-1, Top Portion of Menu



The second section of the menu shows the Full Backup Archive that this Delta is using. For Delta restores you need the matching Full Backup so make sure you restore the matching full as well to the new esx host and it is accessible. *(Figure sh-2).*

Figure sh-2, Matching Full Backup

The third section is the Various Menu Options for the Delta restore (*Figure sh-3).* These include restoring the Delta backup, validating the new vmdk as well as the Full archive among other options.

Figure sh-3, Menu Options

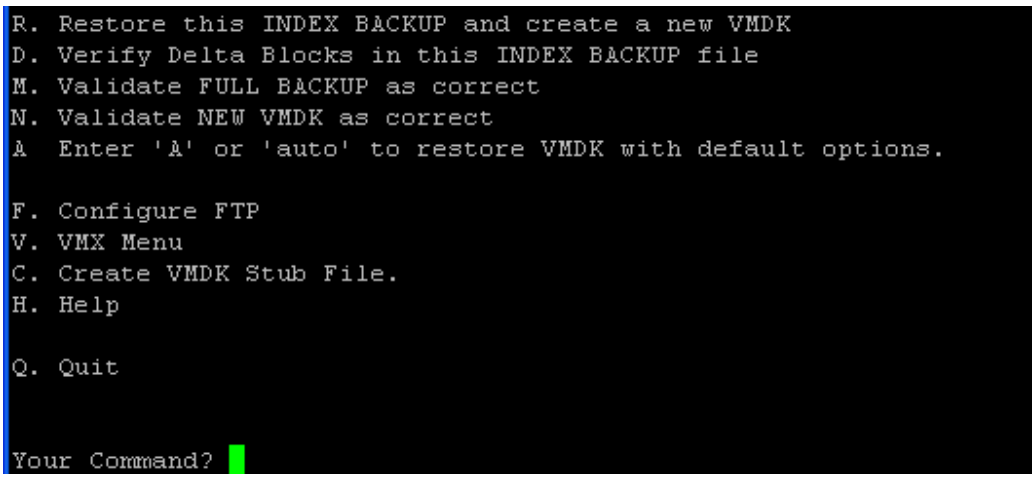


Table sh-1, esXpress sh Delta Restore Menu Options

Option	Description	Function
R	Restore This INDEX BACKUP and create a new VMDK	Restore backup and create a New vmdk
D	Verify Delta Blocks in this INDEX BACKUP file	Verify the Delta Blocks in the backup archive
M	Validate FULL BACKUP as correct	Validate and check the Full archive as the match to the Delta
N	Validate NEW VMDK as correct	Validate new VMDK against backup
A	Enter 'A' or 'auto' to restore VMDK with default options.	Auto Restore Backup using all defaults
F	Configure FTP	Set up FTP
V	VMX Menu	Show VMX Restore Menu
C	Create VMDK Stub File	Create Stub file for GSX/Server
H	Help	esXpress Restore ReadMe
Q	Quit	Quit the PHD esXpress application.

Restore This Index Backup and create a new VMDK.

Choose this option to restore this backup file and create a new VMDK file. You are asked for the new name to restore as, but it defaults to the current VMDK name. When a backup is being restored the FULL backup is pulled directly from the FTP server (unless it's locally on the same drive as this backup file) and a new VMDK file is created. If you are restoring this backup on ESX, then you can safely do more then one restore at time, as we create the new VMDK using vmkfstools, then we import the backup directly into this new VMDK file. Otherwise restoring more then one backup on the same file system will created severely fragmented files.

The first thing you need to do is select which Full backup archive to use. The menu will present a default if it finds one either local or from ftp if configured. You can accept the default by just hitting Enter or provide the full path and file name.

```
Your Command? R


**************************************************
* Restore a DELTA INDEX BACKUP to a NEW VMDK File *
**************************************************

To restore an INDEX BACKUP I need to know the location
of the FULL BACKUP. Pull from FTP not set.

Enter the full path of the FULL BACKUP File here, 'q' to quit
or Enter to accept the default of
'../2008.04.07-RedHat_VM1.564d1e34-4364-1808-23fd-e56565add965.FULL/00-RedHat_VM1.vmdk.gz-
080407-1110.phd'

 What FULL Backup do you want to use?
```

The second step is to define the new VMDK name included its Full Path. Hit Enter to accept the default or provide the new name and full path.

```
To create a new NEW VMDK file you need to enter the fully
pathed name such as: /vmfs/folder/name.vmdk

Enter 'q' to quit or
Press Enter to accept default './RedHat_VM1-flat.vmdk'

 Create what fully pathed VMDK file?
```

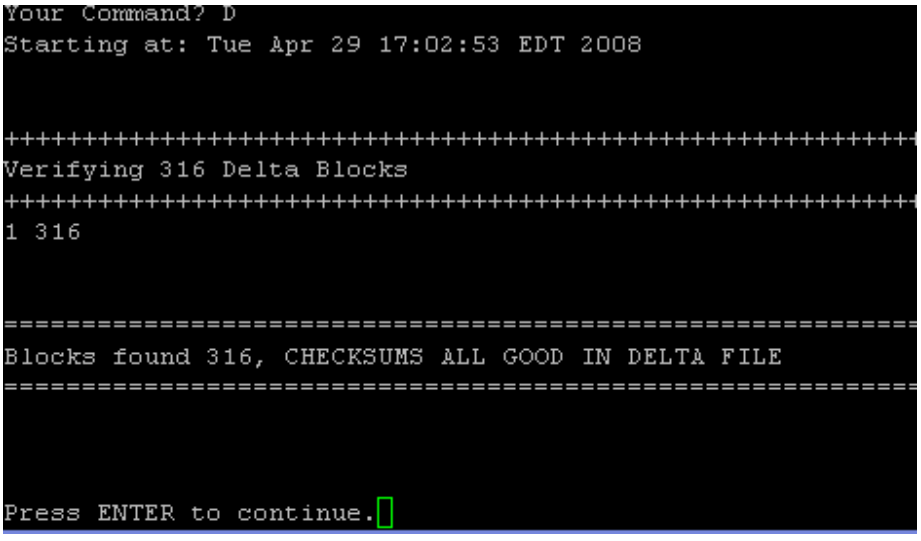
The last step is to confirm your choices and proceed with the restore. You must enter '**yes**' to continue, enter 'q' to quit.

```
************************************************
* Ready to create a NEW VMDK from INDEX Backup *
************************************************

Accessing FULL BACKUP from File
 ../2008.04.07-RedHat_VM1.564d1e34-4364-1808-23fd-e56565add965.FULL/00-RedHat_VM1.vmdk.gz-080407-1110.phd

Create NEW VMDK File: './RedHat_VM1-flat.vmdk'

Ready to continue (Enter 'yes' to continue, 'q' to quit)?
```

Verify Delta Blocks in this INDEX BACKUP File

This option will verify the Delta blocks in this INDEX backup. When you are doing a RESTORE, only the first 3,000 blocks will be checked, so choose this option if you want to verify all blocks beforehand.

Figure sh-4, Verify Delta Blocks



If the verify is correct you will see the following message:

CHECKSUMS ALL GOOD IN DELTA FILE

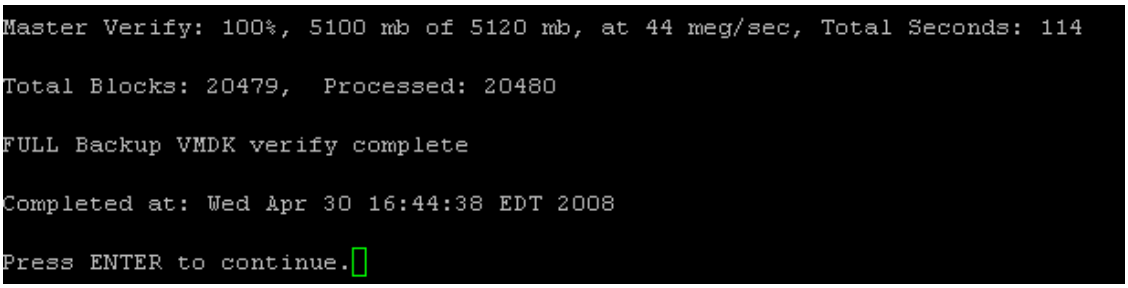
Validate FULL BACKUP as correct

This option will validate a VMDK as the FULL Backup that was used when this INDEX backup was made. If the file is local it will be used. If FTP is configured, then the FULL backup will be pulled and verified through FTP.

```
Your Command? M


Verify FULL Backup as correct for this Delta.

Default: '../2008.04.07-RedHat_VM1.564d1e34-4364-1808-23fd-e56565add965.FULL/00-
RedHat_VM1.vmdk.gz-080407-1110.phd'

Press Enter to accept default or 'q' to quit.

 Verify what FULL Backup?

****************************************
* Verify a FULL Index to a FULL Backup *
****************************************

Verify FULL BACKUP from
File: '../2008.04.07-RedHat_VM1.564d1e34-4364-1808-23fd-e56565add965.FULL/00-
RedHat_VM1.vmdk.gz-080407-1110.phd'

Ready to continue (Enter 'yes' to continue, 'q' to quit)? yes
Starting at: Wed Apr 30 16:42:44 EDT 2008


Verifying FULL BACKUP File, 20479 Blocks in file:
 ../2008.04.07-RedHat_VM1.564d1e34-4364-1808-23fd-e56565add965.FULL/00-RedHat_VM1.vmdk.gz-
080407-1110.phd
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

This is just a verify, you can safely abort (hit ^C).

Master Verify: 14%, 700 mb of 5120 mb, at 63 meg/sec, Total Seconds: 10
```

When the Full verification is complete you should see a message similar to the figure (*Figure sh-5*) below showing the Master is 100& verified and that Full Backup VMDK verify is complete. If an error is shown there was a problem with the Full Backup that needs to be looked into.

Figure sh-5, Verify Delta Blocks



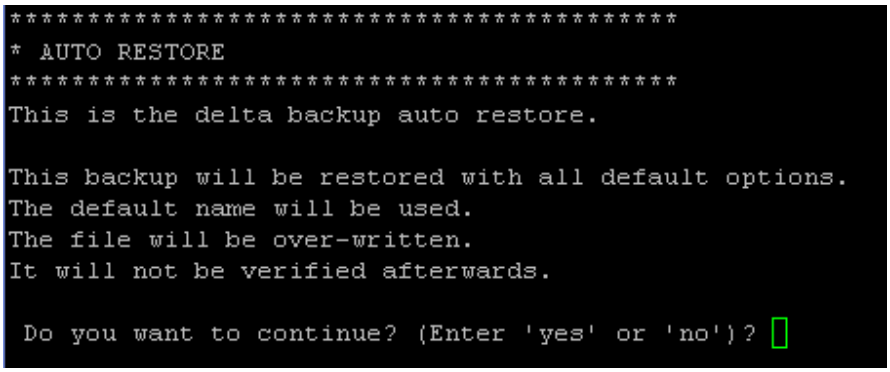
Validate NEW VMDK as correct

This option will validate a VMDK and compare it to the INDEX Backup that was used to make this INDEX backup. This is also done when a RESTORE is completed.

Enter ‘A’ or ‘auto’ to restore VMDK with default options

The auto restore option will use all the Default settings when restoring the vmdk. For example the default name, the original location, etc. When you choose this option you will be prompted to confirm if you wish to continue (*Figure sh-6*). Enter ‘yes’ to confirm or ‘no’ to abort the restore.

Figure sh-6, Auto Restore Confirmation



Once entering yes, you will see the default values being used for the restore. The answer ‘Autorun Restore’ is automatically set for each question for the restore. They include, the

correct Full Backup and the path for the new vmdk. Before choosing the auto run restore make sure the correct Full Backup is accessible either by configuring FTP or copying the matching Full Backup to the same directory as the Delta you are restoring.

```
Do you want to continue? (Enter 'yes' or 'no')? yes

Auto Restoring Backup with Defaults


************************************************
* Restore a DELTA INDEX BACKUP to a NEW VMDK File *
************************************************

To restore an INDEX BACKUP I need to know the location
of the FULL BACKUP. Pull from FTP not set.

Enter the full path of the FULL BACKUP File here, 'q' to quit
or Enter to accept the default of
'../2008.05.02-Fedora_VM1.564d1e34-4364-1808-23fd-e56565add965.FULL/00-Fedora_VM1.vmdk.gz-
080502-1113.phd'

 What FULL Backup do you want to use? Autorun Restore
############################################################


To create a new NEW VMDK file you need to enter the fully
pathed name such as: /vmfs/folder/name.vmdk

Enter 'q' to quit or
Press Enter to accept default './Fedora_VM1-flat.vmdk'

 Create what fully pathed VMDK file? Autorun Restore
```

The below steps show the new vmdk being created using vmkfstools which the restore backup will be imported into.

```
************************************************
* Ready to create a NEW VMDK from INDEX Backup *
************************************************

Accessing FULL BACKUP from File
 ../2008.05.02-Fedora_VM1.564d1e34-4364-1808-23fd-e56565add965.FULL/00-Fedora_VM1.vmdk.gz-
080502-1113.phd

Create NEW VMDK File: './Fedora_VM1-flat.vmdk'

Ready to continue (Enter 'yes' to continue, 'q' to quit)? Autorun Restore
*****************************************
*  Checking if Import VMDK is available.  *
*****************************************
```

```
vmkfstools -c '5242880k' -a lsilogic './Fedora_VM1.vmdk'

New VMDK: './Fedora_VM1.vmdk'
New Flat: './Fedora_VM1-flat.vmdk'
Successfully Created.

Backup VMDK Size: 5368709120

-rw-------  1 root  root  5368709120 May  5 14:10 ./Fedora_VM1-flat.vmdk
-rw-------  1 root  root         376 May  5 14:10 ./Fedora_VM1.vmdk

Backup will be imported into new VMDK file.
Because esXpress v3 imports the backup into the New VMDK, you can do multiple restores at once.
Starting at: Mon May  5 14:10:34 EDT 2008
```

The next step in the autorun restore is the verification of the Delta blocks in the backup.

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Verifying 255 Delta Blocks
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
1 255


========================================================================
Blocks found 255, CHECKSUMS ALL GOOD IN DELTA FILE
========================================================================
```

The last messages you will see is the running status of the backup restore. In this example 69% of the Delta backup has been processed so far and 45% of the Full has. The estimated time remaining for the restore is 3 minutes and 21 seconds.

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Delta Blocks Found: 255
Restoring VMDK file: ./Fedora_VM1-flat.vmdk, 20480 Blocks in file
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Delta: 69%  Full: 45%, 2300 mb of 5120 mb, at 14 meg/sec, Elapsed: 02:41s  Remaining: 03:21s
```

Upon the successful completion of the Autorun Restore you will see messages similar to the following, showing a good checksum and the successfully created vmdk files.

```
Delta: 100%  Full: 100%, 5100 mb of 5120 mb, at 14 meg/sec, Elapsed: 06:03s  Remaining: 01s

Total Blocks: 20480,  Processed: 20480


========================================================================
CHECKSUMS ALL GOOD IN VMDK FILE:
 ../2008.05.02-Fedora_VM1.564d1e34-4364-1808-23fd-e56565add965.FULL/00-Fedora_VM1.vmdk.gz-
080502-1113.phd
========================================================================
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Skipping Verify of NEW VMDK file

VMDK successfully created: './Fedora_VM1-flat.vmdk'
-rw-------    1 root     root         5.0G May  5 11:02 ./Fedora_VM1-flat.vmdk

VMDK successfully created: './Fedora_VM1.vmdk'
-rw-------    1 root     root          376 May  5 14:10 ./Fedora_VM1.vmdk


Completed at: Mon May  5 14:16:41 EDT 2008



Thank You for using PHD esXpress v3 Backups, www.esxpress.com
```

Configure FTP

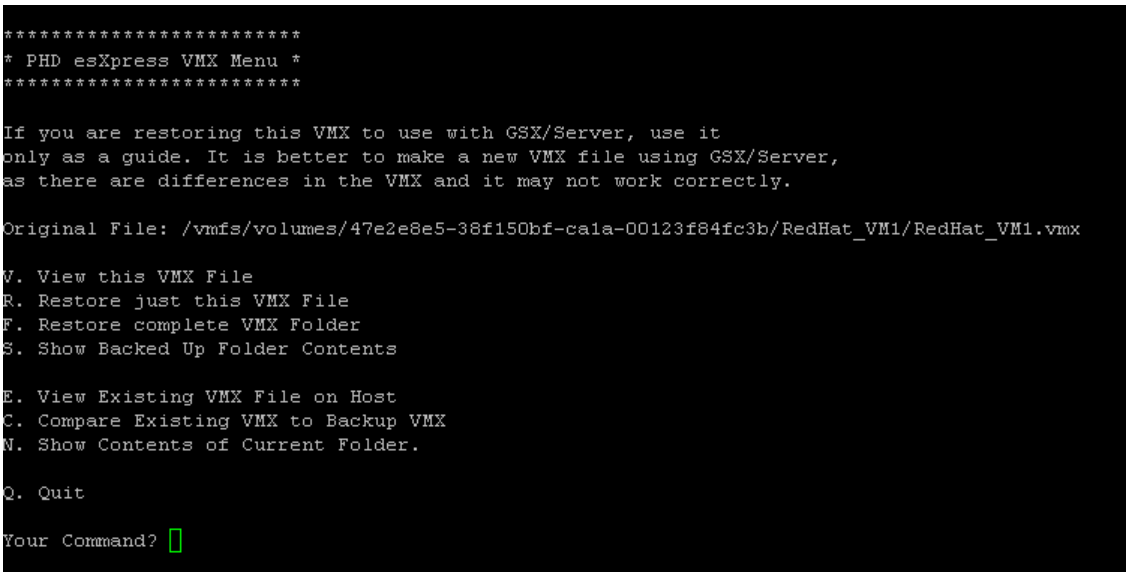
From within the restore menu you can set up a FTP server if needed to go and download the matching Full backup for the Delta backup being restored.

```
Your Command? F


This DELTA backup can pull the FULL backup from your FTP host.
What FTP Server ('q' to quit, Enter to accept []): 192.168.1.110

What User Name ('q' to quit, Enter to accept []): ftpuser

What Password ('q' to quit, Enter to accept []): ftpuser

What /Path/File ('q' to quit, Enter to accept []): /backups/esXpress


You Entered the following FTP information.

   Server: 192.168.1.110
     User: ftpuser
     Pass: ftpuser
File Path: /backups/esXpress

Is this correct (Enter 'yes' or 'no')?
```

VMX Menu

This menu (*Figure sh-5*) will allow you to restore the VMX file, NVRAM and logs from when this backup was made. You can save it to any path, and it will ask you if you want to register the VMX file. Do not use an ESX VMX file with GSX/Server. Make a new one, but use the old one as a guide.

Figure sh-5, VMX Menu



Create VMDK Stub File

You can use your ESX VMDK files directly with other VMware products. There is almost nothing different between an ESX VMDK vs GSX/Server Pre-Allocated disk. If you create a STUB file that points to the ESX VMDK then you can use it directly on your Backup server or any machine. When you configure an 'Existing Virtual Disk' just point to the STUB file. Make sure the VMDK and the STUB file are in the same folder if you move them.

```
Your Command? C


**********************************************************
* Create Stub File for using ESX VMDK with GSX/Server *
**********************************************************
```

```
The Size of this VMDK Backup is: 5368709120

The most recently restored VMDK
File is:
Size is:

Your Creation Options are as Follows:

1. Point to a different file and make a Stub file.

What do you want to do? ('q' to Quit)?
```

Encrypted Archives

You can restore encrypted delta archives as well with this command line method and not having the esXpress software installed.

In this case an additional menu option will be shown to Set the Passwords to be used for the encrypted archive.

P. Set Passwords - PASSWORDS SUCCESSFULLY SET
P. SET PASSWORDS
This option allows you to set the password for this backup file and the password for the FULL backup. If you are restoring from the PHD menu, then the passwords will be passed from the menu to this restore program. You can also set Environment variables.

Help – Shows online Restore Help File (this file is provided in this manual under the heading ‘Command Line Restore Help File’).

Quit – Quits the Restore process and returns to command line prompt.

Best Practices

esXpress is a vmdk restore based product. With this in mind we recommend that in a DR scenario or when you are restoring to an esx host without the esXpress software installed to Pre-Create the Virtual Machine from within the VI3 client.

While esXpress can restore the vmx file from the original backup we do not make any changes to it. So with a new host when they could be different settings in the vmx (for example, VM location, different datastore, possible duplicate vmdk names, network differences, VM memory allocation and others) we don't attempt to update the vmx file directly and cause possible additional issues.

This is why we recommend creating the VM upfront from the VI3 client. When creating the VM you would set the following settings as normal :

- VM Name and location
- DataStore
- Resource Pool if applicable
- CPUs
- Memory
- Network
- Virtual Disk (s) - create the virtual disk the same size as the original vmdks from the backups.

Now you will have a fresh VM, set up correctly for the new host and then can just restore the esXpress vmdk backup directly over the blank vmdk you created with the VM. This makes for a much cleaner restore and recovery.

*** Note – If you do choose to restore the VMX from the backup, this will also work but you need to go to the VI3 client and make any necessary changes to the VM as a result of the new esx host environment.*

Command Line Restore Help File

*** This is the online file from the delta shell restore ***

This is the help. More to come.

PHD ESXPRESS DEFINATIONS:
A FULL Backup - This is a complete copy of a VMDK file, it may be
compressed or encrypted. The un-encrypted version is
just a plain gzip file. The encrypted version is also
a runnable program like a Delta backup.

A DELTA Backup - This is only the blocks that we're different when compared
to the original FULL backup. The backup file is also
an executable program that will rebuild the backup from
the Delta blocks in this backup and with the FULL backup.

An INDEX Backup - Is a different name for the DELTA backup. We say an INDEX
backup of DELTA blocks.

When you run the backup files, you can pass it parameters.
AUTORUN - This will activate the AUTORUN features in the restore program.
RESTORE - The backup will try to restore itself using default parameters,
only works on local space, no FTP yet.
DELTA - Used with AUTORUN, a Delta block verify will execute automatically.
VERIFY - Used with AUTORUN, the default is not to Verify a restored VMDK.
This option enables the Verify option.
IGNORE - Set to Ignore errors. Keep restoring or verifying even with ERRORS.
NOABROT - Do not allow aborts from restores.
EXIT - Exit out of Restore menu on errors when AUTORUN. Normal action is
to stay at the menu in case of an error.

MENU OPTIONS:
P. Set Passwords - PASSWORDS SUCCESSFULLY SET
P. SET PASSWORDS
This option allows you to set the password for this backup file
and the password for the FULL backup. If you are restoring from
the PHD menu, then the passwords will be passed from the menu
to this restore program. You can also set Environment variables.

R. Restore this INDEX BACKUP and create a new VMDK
Choose this option to restore this backup file and create a new
VMDK file. You are asked for the new name to restore as, but it
defaults to the current VMDK name. When a backup is being restored
the FULL backup is pulled directly from the FTP server (unless it's
locally on the same drive as this backup file) and a new VMDK file
is created. If you are restoring this backup on ESX, then you can
safely do more then one restore at time, as we create the new VMDK

using vmkfstools, then we import the backup directly into this new VMDK file. Otherwise restoring more then one backup on the same file system will created severely fragmented files. This applies to every restore method out there, except for esXpress and vmsnap.pl

D. Verify Delta Blocks in this INDEX BACKUP file
This option will verify the Delta blocks in this INDEX backup. When you are doing a RESTORE, only the first 3,000 blocks will be checked, so choose this option if you want to verify all blocks beforehand.

M. Validate FULL BACKUP as correct
This option will validate a VMDK as the FULL Backup that was used when this INDEX backup was made. If the file is local it will be used. If FTP is configured, then the FULL backup will be pulled and verified through FTP.

N. Validate NEW VMDK as correct
This option will validate a VMDK and compare it to the INDEX Backup that was used to make this INDEX backup. This is also done when a RESTORE is completed.

F. Configure FTP
You can configure the FTP server options for where to get the FULL backup from.

V. VMX Menu
This will allow you to restore the VMX file, NVRAM and logs from when this backup was made. You can save it to any path, and it will ask you if you want to register the VMX file. Do not use an ESX VMX file with GSX/Server. Make a new one, but use the old one as a guide.

C. Create VMDK Stub File.
You can use your ESX VMDK files directly with other VMware products. There is almost nothing different between an ESX VMDK vs GSX/Server Pre-Allocated disk. If you create a STUB file, that points to the ESX VMDK, then you can use it directly on your Backup server or any machine. When you configure an 'Existing Virtual Disk' just point to the STUB file. Make sure the VMDK and the STUB file are in the same folder if you move them.

H. Help
This file you are reading.

Q. Quit
Exit this menu and go back to a prompt.

IGNORE - Ignore Checksum errors, verify/restore anyhow.
Type in 'ignore' to toggle between on and off. Default is OFF.

ENV VARIABLES:
If you are doing multiple verifies/restores on your backup server and you don't want to type in the password to un-encrypt your backups, you can set the following environment variables. This backup restore program will automatically try the passwords passed to it.

export USE_SPASS="the system passphrase"
export USE_MPASS="the master password phrase"

export USE_DPASS="Password for Delta"
export USE_FPASS="Password for Full"

The Folder to use when doing automatic restores.
export USE_RPATH="/vmfs/LOCAL"

Or a complete file path.
export USE_RFULL_PATH="/vmfs/LOCAL/file.vmdk"

And the FTP path can be set by:
export PHD_LYNX="ftp://user:password@ftpsite/pathname/to_backuo/file_name.FILL.gz"

RESTORE PROGRAM OPTIONS
Try these examples on your backup server. We're using dft01 in our examples. Don't actually enter a '#', that's there to simulate a shell prompt on your Linux/ESX/CYGWIN(Windows) server.

Run the esXpress Restore Menu in the Backup File. Which gives you the ability to restore this backup.
sh 1001-dft01.vmdk.delta-2006.04.19-2001-060402

Automatically verify the Delta Blocks in the Backup File, less then 10 errors.
sh 1001-dft01.vmdk.delta-2006.04.19-2001-060402 auto run delta

Automatically verify the Delta Blocks in the Backup File, and accept no errors.
sh 1001-dft01.vmdk.delta-2006.04.19-2001-060402 auto run delta no errors

If you're running a 'delta' or a 'restore' in AUTORUN mode, and an ERROR happens, the default action is to stay at the menu. By using the 'exit' option, it will always exit from the restore menu/program. Such as:
sh 1001-dft01.vmdk.delta-2006.04.19-2001-060402 auto run delta no errors exit

Automatically RESTORE this Backup File, with all default options. The default is to name the file the same as the backup and create it in the current directory. The Default Path can be set with an Environment variable. Our DEFAULT name would be 'dft01.vmdk' in our example.
sh 1001-dft01.vmdk.delta-2006.04.19-2001-060402 auto run restore

After a RESTORE is complete, the default action is NOT TO VERIFY when running in 'autorun' mode. If you want to VERIFY, add the 'verify' command.
sh 1001-dft01.vmdk.delta-2006.04.19-2001-060402 autorun restore verify

WHY
You might be asking yourself, 'Why do I care about this?'
By knowing a little about shell scripting you can easily restore all your backup files. You can have your backup server verify your backups every day. You can setup a cronjob that restores the VMDK files from your Exchange or other servers that you frequently need. When the Boss deletes the wrong email you can literally have it 'ex-merged' within minutes.

A simple script to verify all the delta's would be (cut & paste):

```
export USE_SPASS="system.password"
export USE_RPATH=/u
for i in `ls [0-9]*`
do
   sh $i autorun delta noerrors
 done
```

Replace the word 'delta' with 'restore' and you sit back and watch all your VMDKs restore. You should not restore more then one at a time on a particular filesystem (unless your just testing) because with multiple restores running will cause the VMDKs to be heavily fragmented.

Better AUTORUN options coming.

Restoration of a Virtual Machine to a Non-ESX Host Via the Command Line

Delta Files –

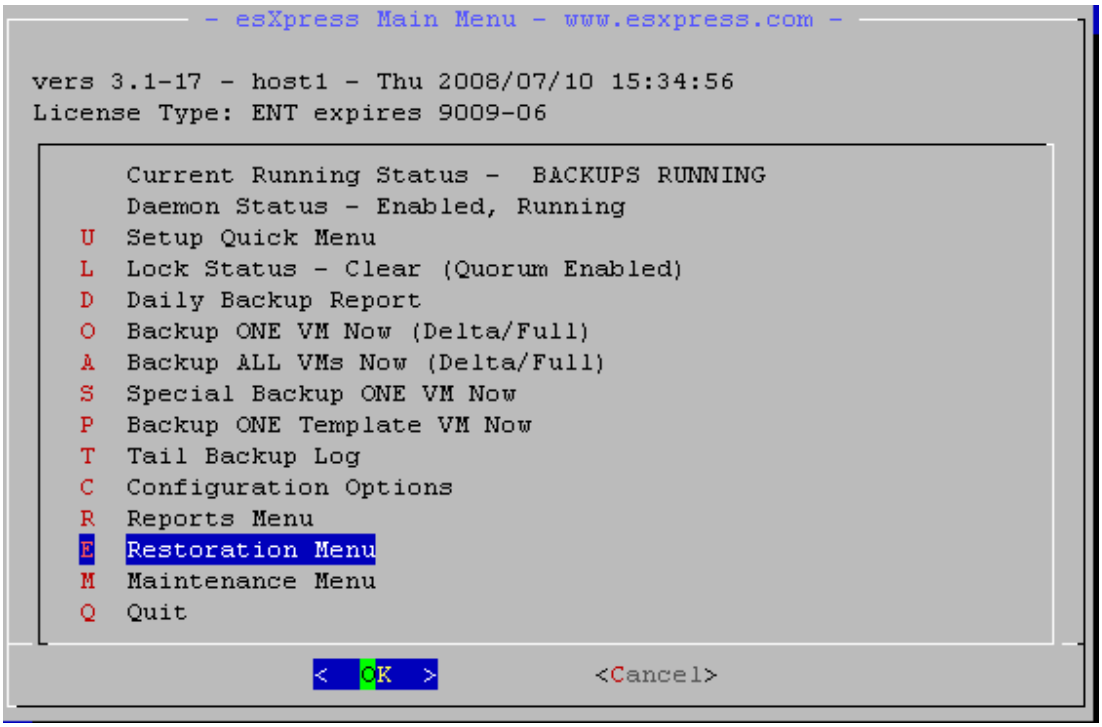
There is a tutorial on the esXpress web site documentation page explaining how to restore a Delta backup to a Windows Host.

http://www.esxpress.com/cygwin/index.php

Restoration of a Virtual Machine via the esXpress Console Menu

To start the esXpress software, type **phd** at the command prompt. The esXpress Backup Menu will open.

Figure 2, esXpress Main Menu



The first three selections displayed are also status indicators. In the above example, the first selection, **Current Running Status**, will show you if backups are currently running, and note if you had any errors. The second selection, **Daemon Status**, also displays the current status of the background daemon. The third selection, **Lock Status**, also displays the current lock status. Restorations respect lock status.

NOTE: If accessing esXpress via SSH using putty.exe, make sure to enlarge the window beyond the default size, or open and run in full screen. The default window size is not always sufficient to display all backup archives when accessing the Restoration Menu.

Select the **Restoration Menu** by using the mouse, arrow keys or pressing the "**E**" hot key.

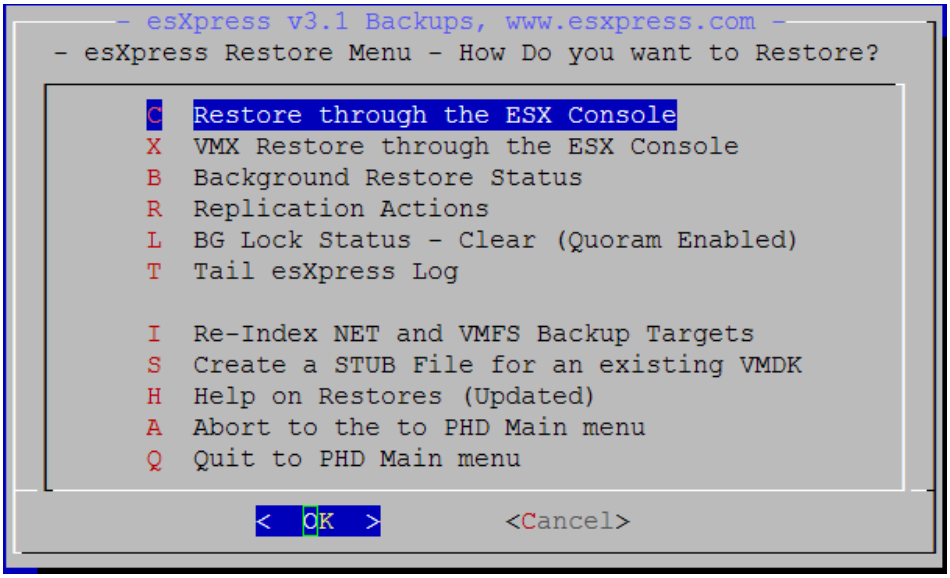
This menu allows you to initiate restores of entire virtual machines, single VMDK files, and individual VMX files as well.

The following table (Table 1) describes the available menu options and their function.

Table 2, esXpress Restore Menu Options

Option	Description	Function
C	Restore through the ESX Console	Initiates the esXpress Restore process
X	VMX Restore through the ESX Console	Restore a VMX file only
B	Background Restore Status	Shows the current and completion status of all back grounded restorations for that host
R	Replication Actions	Displays the Replication Menu
L	BG Lock Status	Work with restore locks
T	Tail esXpress Log	Views the esXpress backup Log
I	Re-Index NET and VMFS Backup Targets	Re-Index your backup targets.
S	Create a STUB File for an existing VMDK	Creates vmdk Stub File if necessary
H	Help on Restores (Updated)	esXpress Restore ReadMe
A	Abort to the PHD Main Menu	Abort the Restoration Menu
Q	Quit to the PHD Main Menu	Quit the PHD esXpress application.

Figure 3, esXpress Restore Menu

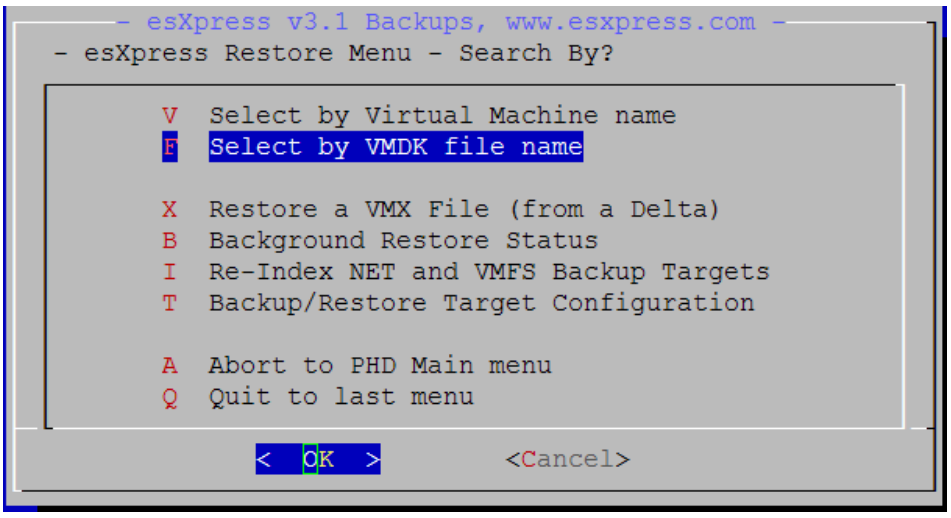


Upon selection the Restore option, if the local database has not been updated within the previous 15 minutes, esXpress will re-index your backup targets to ensure the restore process has the most current backup information.

Figure 3, esXpress Re-Index Backup Target

```
Re-indexing Backup targets

2007-08-26 20:56:27.296r Getting Restore Database from the Backup Targets, from within the Console

Loading restore database from VMFS space /vmfs/volumes/
This could take a few moments...
.....................................................................................................
.....................................................................................................
.....................................................................................................
.................................
```

Figure 4, esXpress Restore Menu – Search By



This menu allows you to restore virtual machines, individual VMDK files, or just the virtual machine configuration file (.vmx).

The following table (Table 1) describes the available menu options and their function.

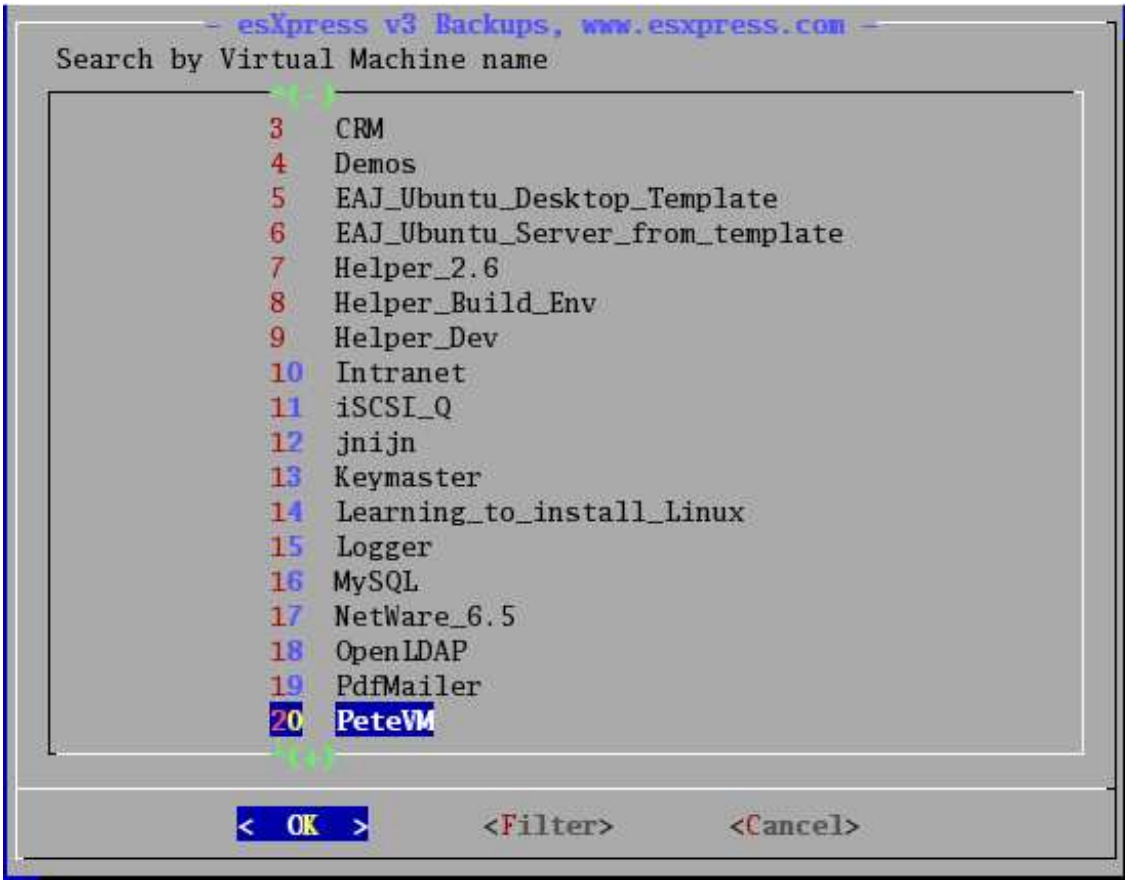
Table 2, esXpress Restore Menu – Search By Options

Option	Description	Function
V	Select by Virtual Machine Name	Restore the selected virtual machine and optionally register it to the host
F	Select by VMDK File Name	Restore just the select VMDK file
X	VMX Restore through the ESX Console	Restore a VMX file only
S	Create a STUB File for an existing VMDK	Creates vmdk Stub File if necessary
B	Background Restore Status	Shows the current and completion status of all back grounded restorations for that host
A	Abort to the PHD Main Menu	Abort the Restoration Menu
Q	Quit to the PHD Main Menu	Quit the PHD esXpress application.

At this point you are ready to choose your backup archive to restore. There are 2 methods of restoration, the entire virtual machine, or just a single VMDK file.

The following menus are of the **Select by Virtual Machine Name** choice. The **Select by VMDK file name** menu option works identically to **Select by Virtual Machine Name**, except the system will not prompt you to register the virtual machine.

Figure 5, esXpress Restore Menu – Search by Virtual Machine Name



This menu displays a list of virtual machines available for restoration and is listed using their VMware display name.

Depending upon the size of your farm, this list can be very large. You can use the **Filter** option to locate a particular virtual machine by entering part of its name into the search box.

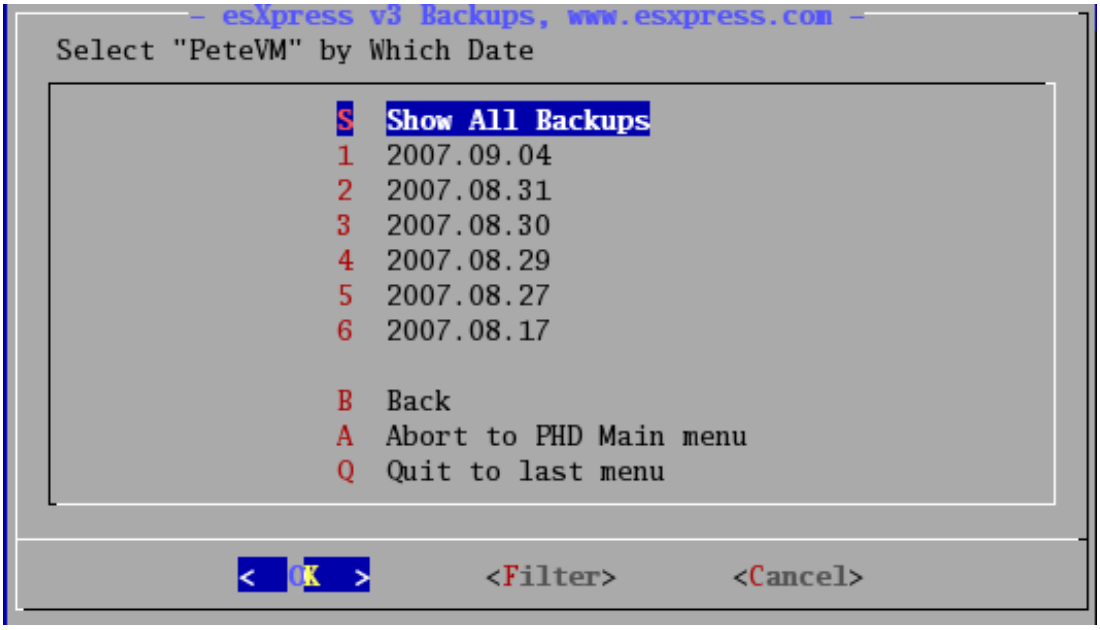
Move the cursor to select the desired virtual machine and press ***Enter***. The system will display a listing of the dates for which archives are available for the selected virtual machine (figure 6). Or you can select Show All Backups to have the system display all archives available for this virtual machine.

Table 3, esXpress Restore Menu – Search By Options

Option	Description	Function
S	Show All Backups	Display all archives for all dates
1 – N	Date	Display archives for only the selected date
B	Back	Return to the previous menu
A	Abort to the PHD Main Menu	Abort the Restoration Menu
Q	Quit to the PHD Main Menu	Quit the PHD esXpress application.

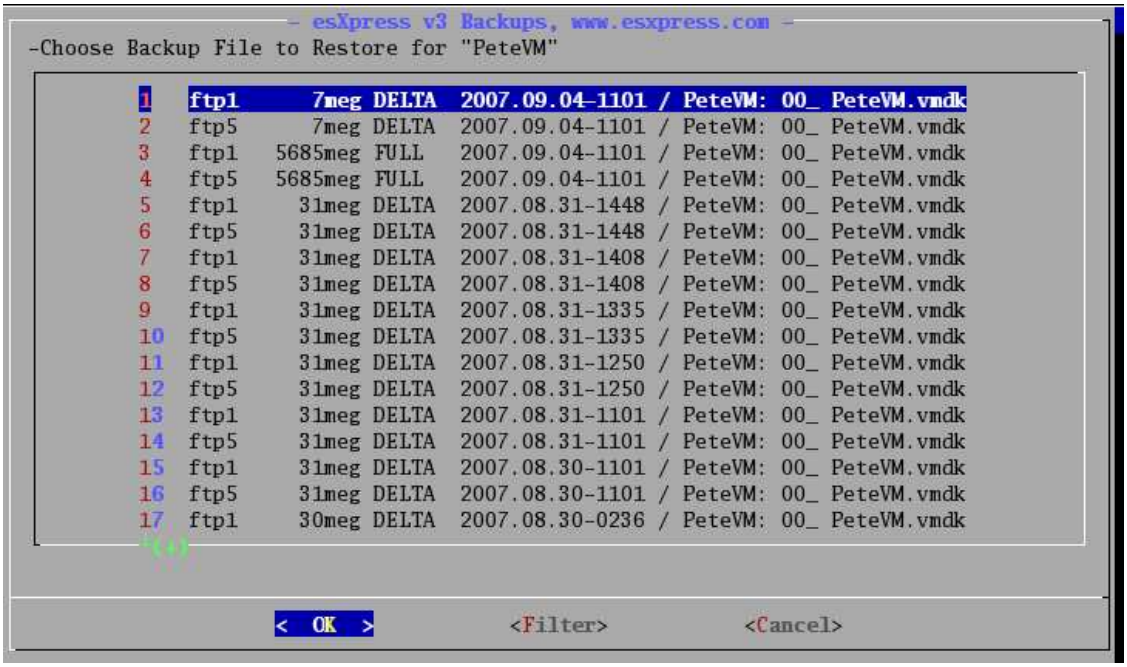
Select the desired archive date or simply pres Enter to see all available archives for the selected virtual machine.

Figure 6, esXpress Restore Menu – Select "virtual machine name" by Which Date



Whether you selected a particular date or all dates, the system will next display all archives available from all defined restoration locations, including fail over hosts. If esXpress is configured to backup to multiple locations, you may have duplicate entries for the selected virtual machine.

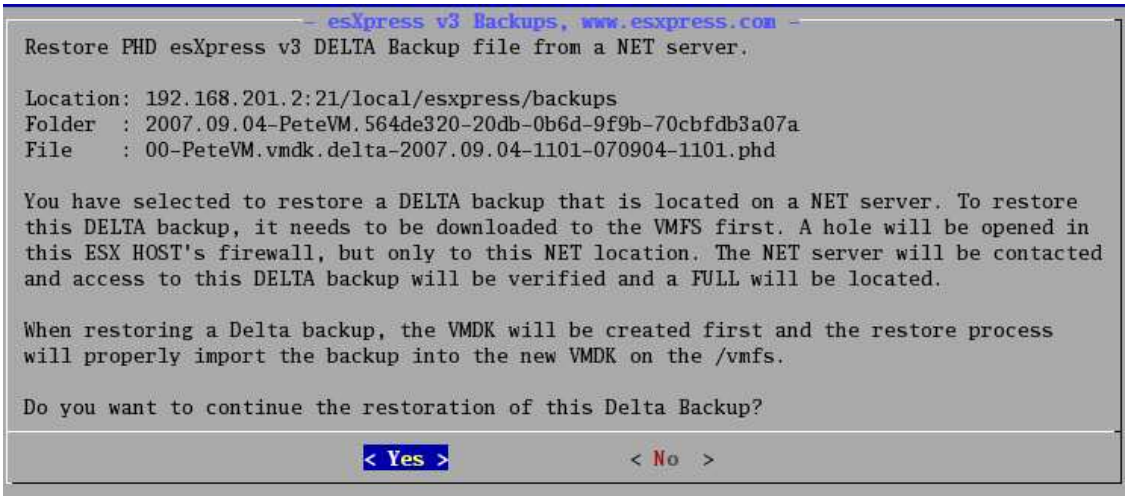
Figure 7, esXpress Restore Menu – Choose Backup File to Restore



At this point you are ready to select the archive file you which to restore, either a Delta or Full archive. When restoring a Delta archive the restore process will also automatically located the associated Full archive. The second column describes where the particular archive is located. If an archive is stored in two or more locations, make sure to select the location that is nearest you (local FTP vs. FTP over the WAN, or VMFS vs. remote SSH) as this can have a dramatic effect on the restoration speed.

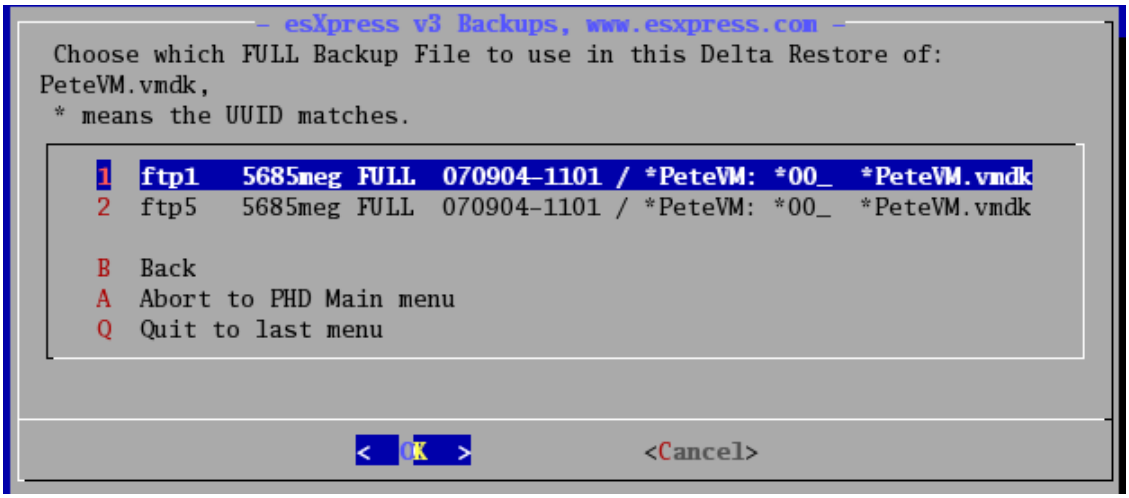
In the following example (figure 8), we have selected to restore a Delta Archive from a network backup target which is a FTP server. A confirmation screen is presented. Make sure to review your selection carefully before Selecting **Yes** to continue.

Figure 8, esXpress Restore Menu – Restoration of a Delta archive



Once you have confirmed this is the correct virtual machine and archive date, the system will ask you to select which FULL archive to restore from, if there are multiple archives available. Again, remember to select the archive that is most local to your location.

Figure 9, esXpress Restore Menu – Confirm Full for Delta Restore



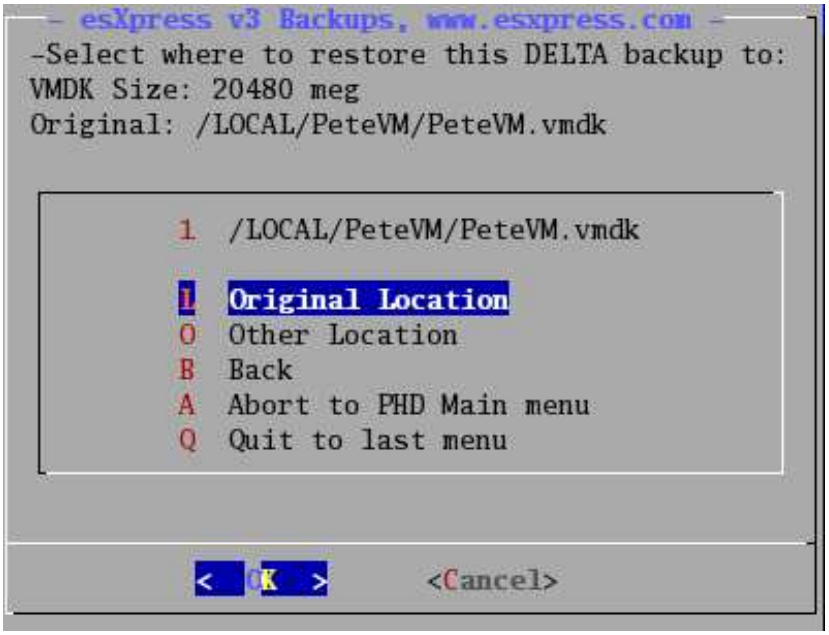
In this example the Full exists on two network backup targets, **ftp1** and **ftp5** (*Figure 9*). The system will ask you to confirm the Full archive for this Delta Restore. Virtual machine names predicated with an asterisk means the system has validated this is the correct FULL archive for the selected DELTA.

For restorations where you are restoring to the virtual machine's original location (or current location if over writing), and restoring with the original VMDK file names, you need to do nothing more then select **Original Location** (*figure 10*), the select **OK** or **Yes** through the remaining restoration menus, accepting the defaults.

Table 4, esXpress Restore Menu – Select Location to Restore To

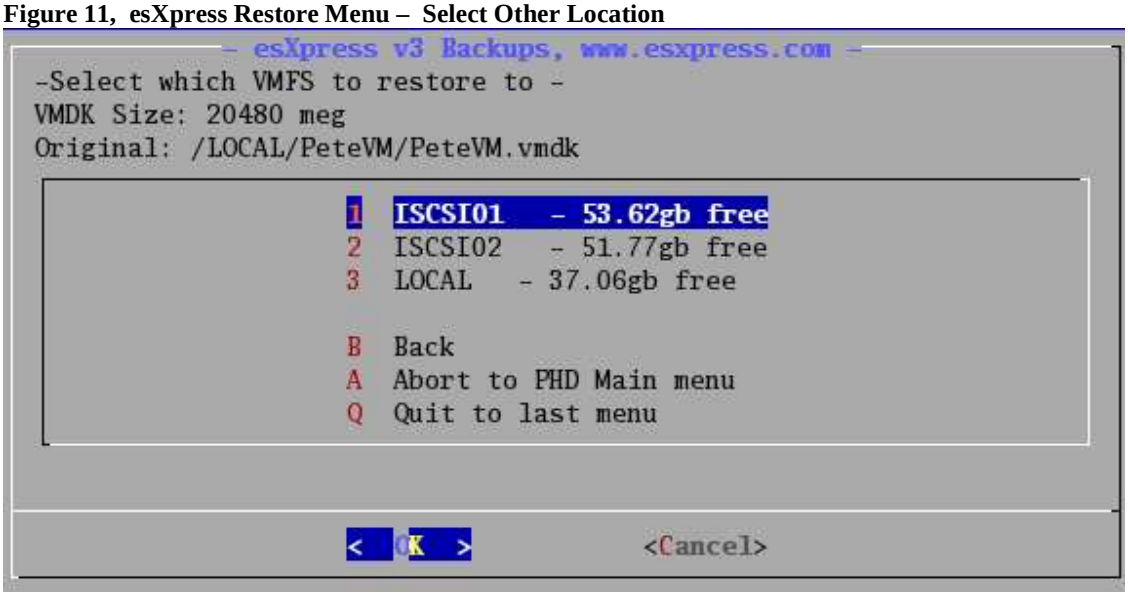
Option	Description	Function
1	Virtual Machine Path	Display/Select original location
L	Original Location	Restore to Original location
O	Other Location	Restore to a different location
B	Back	Return to the previous menu
A	Abort to the PHD Main Menu	Abort the Restoration Menu
Q	Quit to the PHD Main Menu	Quit the PHD esXpress application.

Figure 10, esXpress Restore Menu – Select Location to Restore To



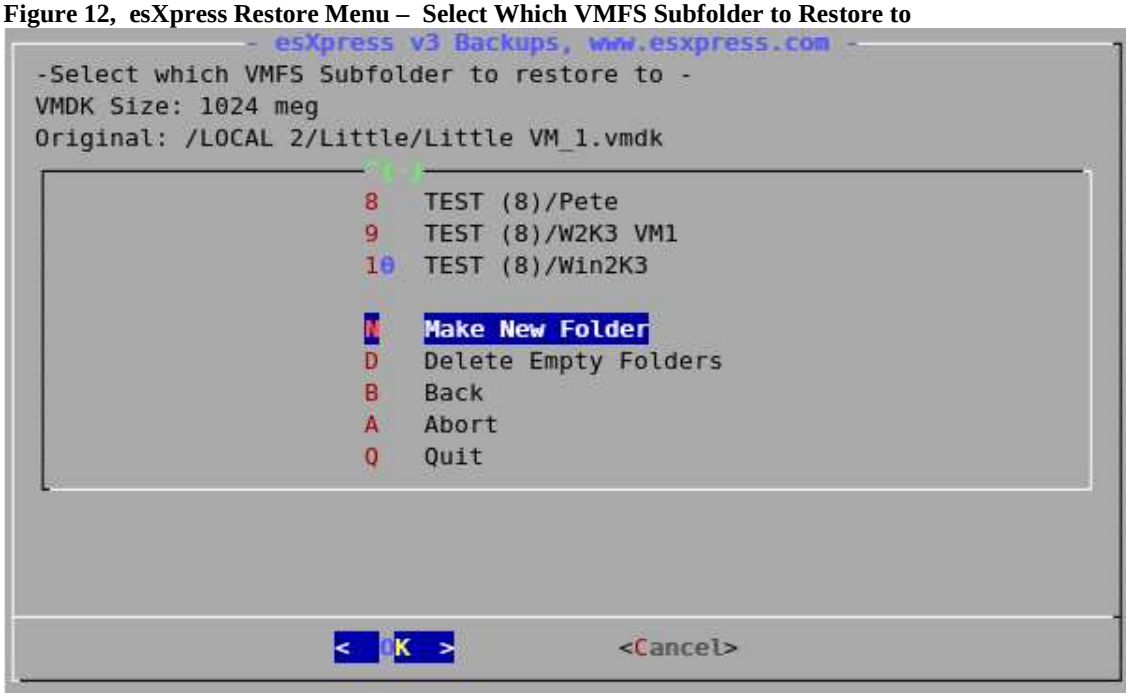
By selecting **Other Location** the system will prompt you to select a VMFS volume and directory, or optionally create a new directory. The menu in *Figure 11* allows you to select from all VMFS volumes presented to that particular host.

Figure 11, esXpress Restore Menu – Select Other Location



Once you have selected the volume to restore to, you are prompted with a list of available subdirectories. If you are not restoring to an existing directory, select **Make New Folder** (*figure 12*).

Figure 12, esXpress Restore Menu – Select Which VMFS Subfolder to Restore to



You are now prompted to enter a name for this new subdirectory.

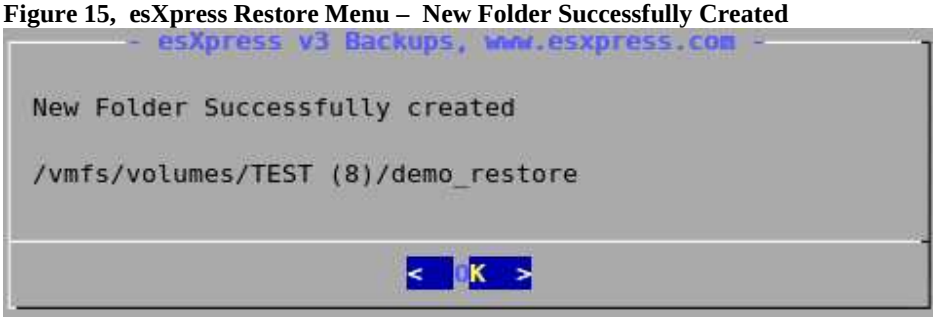
Figure 13, esXpress Restore Menu – Enter New Folder Name

You are then asked to confirm the folder creation. Select **Yes** to continue.

Figure 14, esXpress Restore Menu – Confirm Creation of New Folder

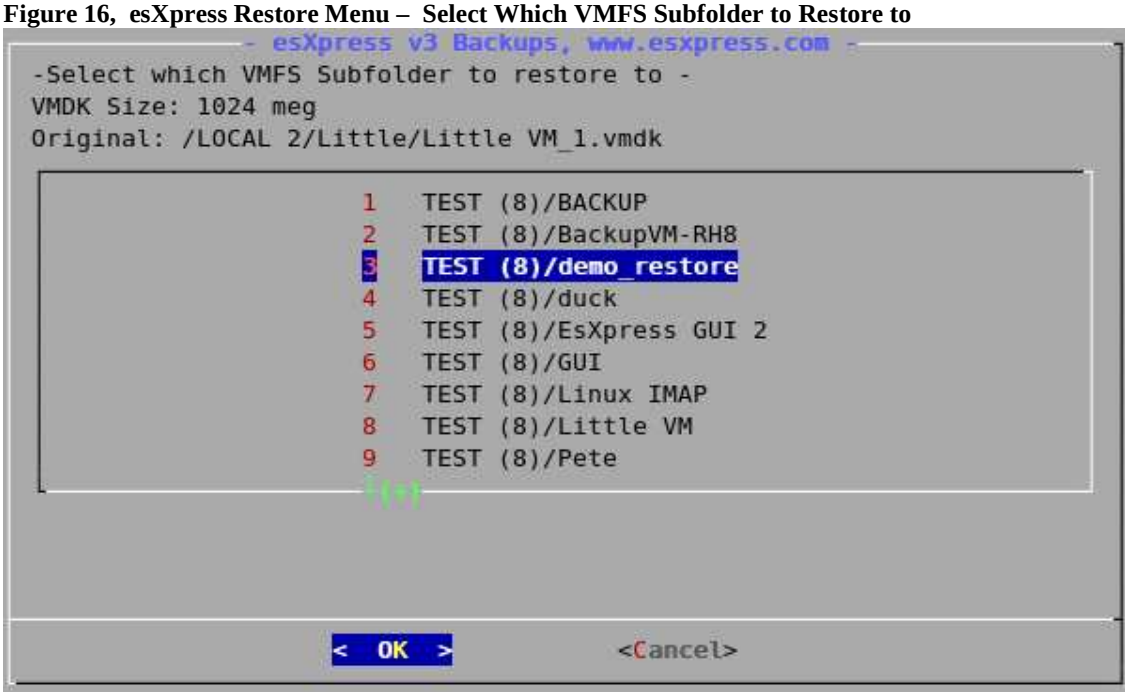
The system will confirm whether or not the folder was created successfully.

Figure 15, esXpress Restore Menu – New Folder Successfully Created



The system will return you to the **Select Which VMFS Subfolder to Restore** to menu, with the newly created directory listed and highlighted.

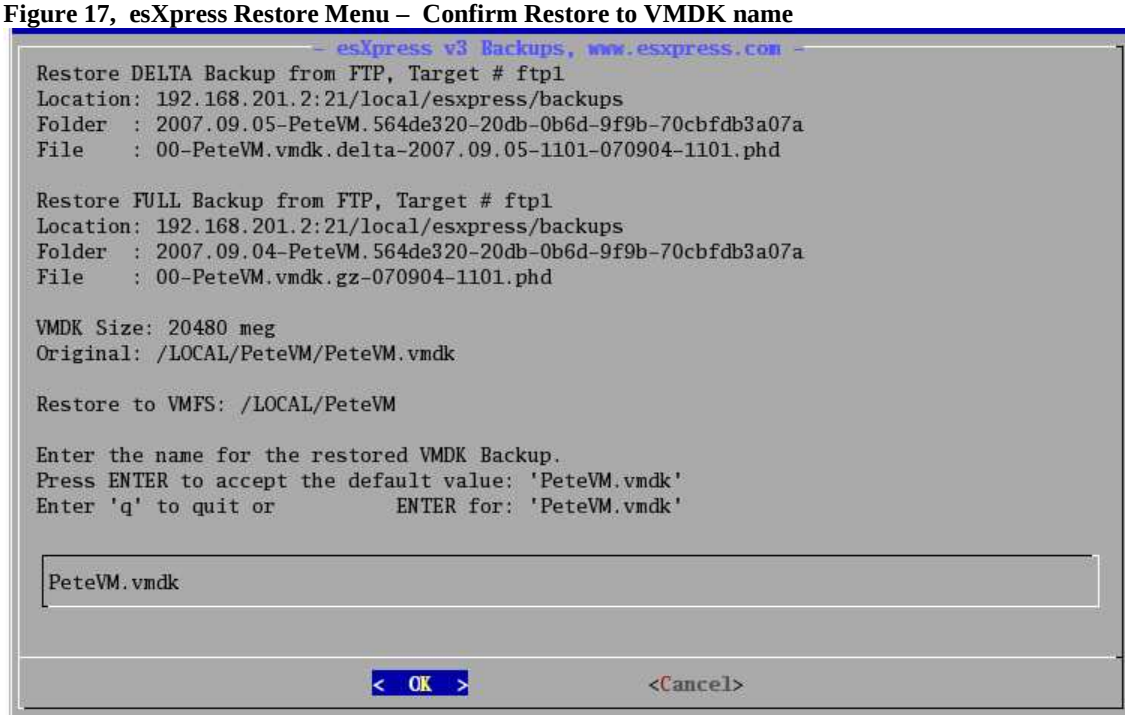
Figure 16, esXpress Restore Menu – Select Which VMFS Subfolder to Restore to



Select the newly created directory.

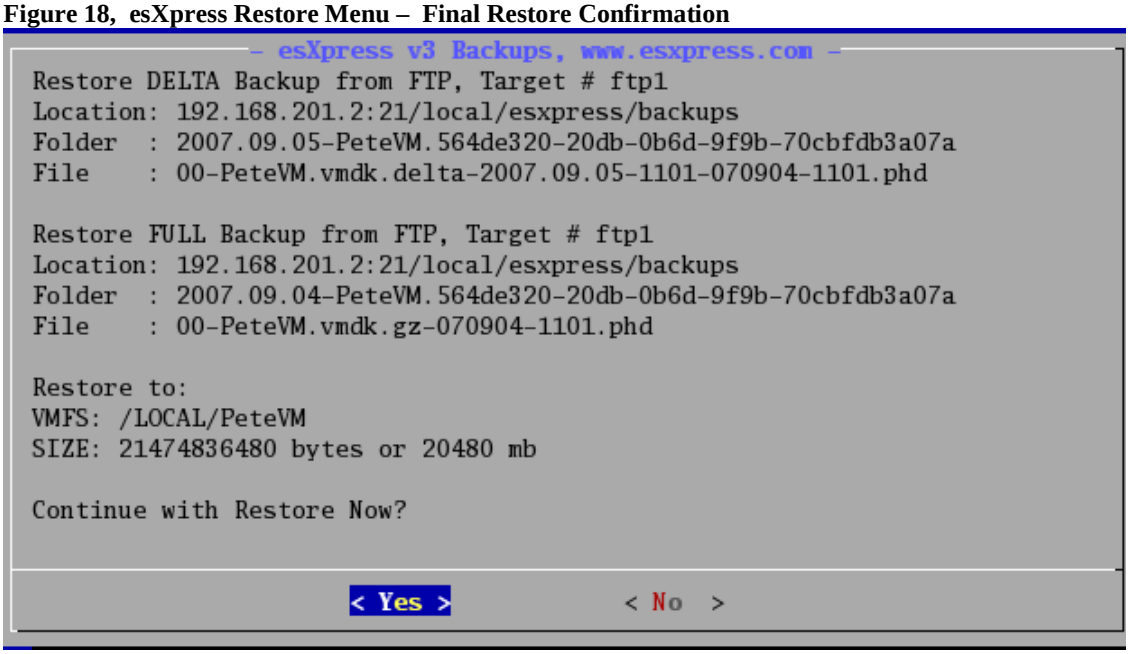
After you have either created a new location, or selected an existing location, the system will ask you to confirm the VMDK name. You can change the name of the VMDK file here if you like (figure 17).

Figure 17, esXpress Restore Menu – Confirm Restore to VMDK name



Note – if you are restoring to the current location, make sure that the virtual machine is powered off. As a safety precaution, esXpress will not restore over a running virtual machine.

Figure 18, esXpress Restore Menu – Final Restore Confirmation

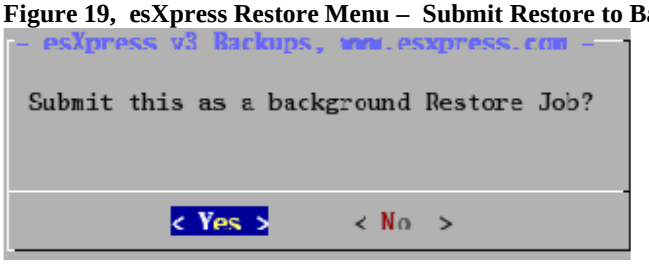


Review the restore information to ensure everything is correct. (*Figure 18*). To continue with restoration of the selected virtual machine, select **Yes**.

esXpress restore engine has the ability to submit the restore job to the background. With this ability you can process multiple restores in the background, releasing your main session. The status of the background restore processes can be checked on the **Main Restore Menu**, under the **Background Restore Status Option**.

Select Restore in background or continue the restore in the foreground (*Figure 19*).

Figure 19, esXpress Restore Menu – Submit Restore to Background



If running the restoration job in the foreground, the process will display the progress (*figure 20*).

Figure 20, esXpress Restore Menu – Sample Restore Screen in Foreground

```
Blocks found 496, CHECKSUMS ALL GOOD IN DELTA FILE
========================================================================



++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Delta Blocks Found: 496
Restoring VMDK file: /vmfs/volumes/LOCAL/PeteVM/PeteVM-flat.vmdk, 81920 Blocks i
n file
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Using FULL from FTP Backup Target
Delta: 1%  Full: 0%, 25 mb of 20480 mb, at 8 meg/sec, Elapsed: 02s  Remaining: 4
Delta: 19%  Full: 1%, 125 mb of 20480 mb, at 25 meg/sec, Elapsed: 04s  Remaining
Delta: 28%  Full: 1%, 150 mb of 20480 mb, at 25 meg/sec, Elapsed: 05s  Remaining
Delta: 29%  Full: 1%, 250 mb of 20480 mb, at 27 meg/sec, Elapsed: 08s  Remaining
Delta: 29%  Full: 2%, 325 mb of 20480 mb, at 29 meg/sec, Elapsed: 10s  Remaining
Delta: 32%  Full: 2%, 375 mb of 20480 mb, at 31 meg/sec, Elapsed: 11s  Remaining
Delta: 33%  Full: 2%, 500 mb of 20480 mb, at 33 meg/sec, Elapsed: 14s  Remaining
Delta: 33%  Full: 3%, 525 mb of 20480 mb, at 32 meg/sec, Elapsed: 15s  Remaining
Delta: 33%  Full: 4%, 725 mb of 20480 mb, at 36 meg/sec, Elapsed: 19s  Remaining
Delta: 34%  Full: 4%, 750 mb of 20480 mb, at 37 meg/sec, Elapsed: 19s  Remaining
Delta: 35%  Full: 4%, 875 mb of 20480 mb, at 36 meg/sec, Elapsed: 23s  Remaining
Delta: 35%  Full: 5%, 925 mb of 20480 mb, at 37 meg/sec, Elapsed: 24s  Remaining
: 08:48s
```

Upon completion of a successfully restore, you should see the following (*Figure 21*).

Figure 21, esXpress Restore Menu – Restore Completion in Foreground

```
================================================================================



++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Skipping Verify of NEW VMDK file

VMDK successfully created: '/vmfs/volumes/LOCAL/PeteVM/PeteVM-flat.vmdk'
-rw-------    1 root     root          20G Sep  5 13:29 /vmfs/volumes/LOCAL/Pete
VM/PeteVM-flat.vmdk

VMDK successfully created: '/vmfs/volumes/LOCAL/PeteVM/PeteVM.vmdk'
-rw-------    1 root     root          312 Sep  5 13:21 /vmfs/volumes/LOCAL/Pete
VM/PeteVM.vmdk



Thank You for using PHD esXpress v3 Backups, www.esxpress.com


Restore process complete

Press ENTER to continue.
```

Press **Enter** to return to the restoration menu.

**** Important Note –**

If you restore to a different location then you must modify the Virtual Machine from the VI3 client to point the vmx to the new location. esXpress does not modify the vmx in this situation. Without doing this step the VM will not power on with a 'File Not Found Error'

Text Menu Restores – Searching using Filter

When searching for esXpress backup archives in environments with a large number of VMs it can become very tedious to page up and down through the Virtual Machine or VMDK search options to find your archive. The Filter feature makes this process much easier and can help you refine your search criteria to find the correct archive quickly.

Figure 18, esXpress Restore Menu – Filter

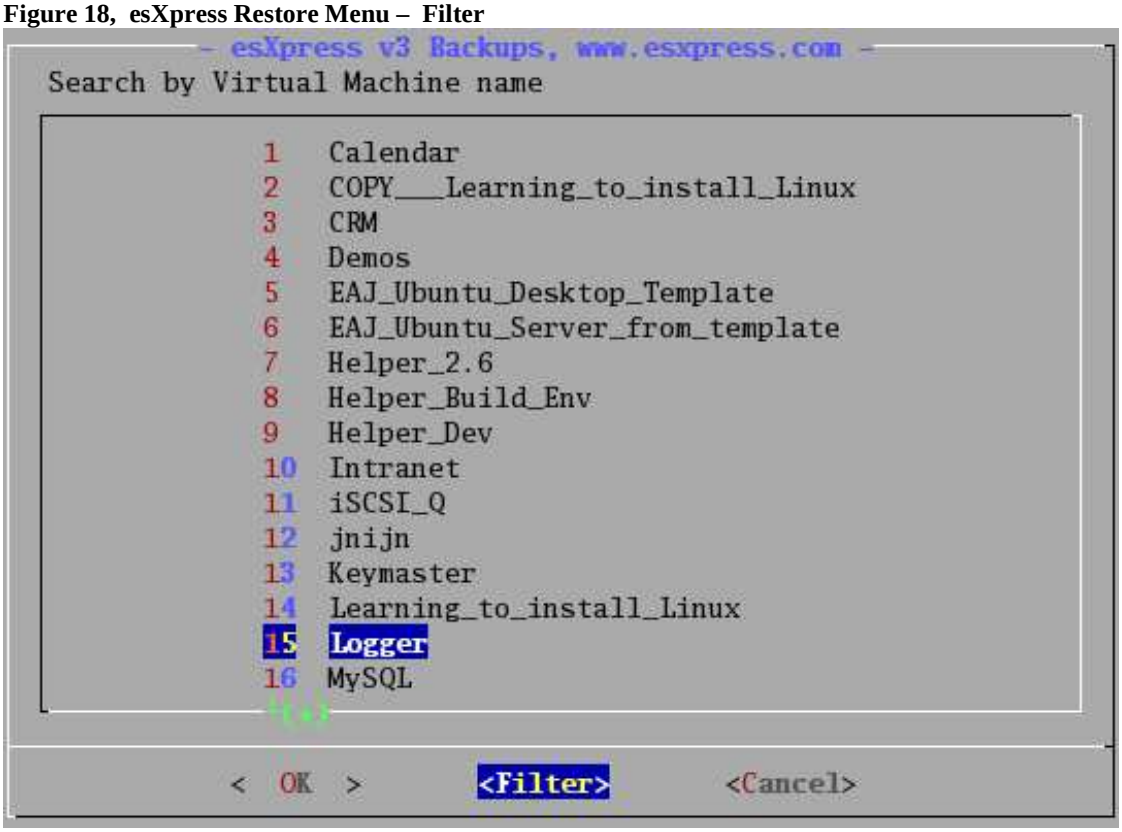


Figure 18 shows the Search by Virtual Machine name menu but the search by VMDK works exactly the same way to filter your search. To setup a search filter highlight "**Filter**" and hit Enter.

In *Figure 19* you have the ability to setup your filter options. Once you have set your filter options highlight **Back** and hit Enter or use the hot key "**B**". Your options will now apply to the search criteria for your restore process. Initially the settings are all set to the default, which is searching everything.

Filter Options :
*Note – to change an option highlight that **Option** and then highlight **OK**, then hit Enter. Highlighting each option and also OK and then hitting Enter will cycle through the available choices.*

- **Filter by Any Part Name** : This will open up a box (*Figure 20*) where you can enter any partial name to limit your search. For example if you are looking for all Virtual Machines that have **dev** in its name then you would enter "dev" here.
- **Filter by Transport Type** : limits by the network target transport types (ALL/SSH/FTP).
- **Filter by VMFS Backup** : There are 3 vmfs filter options available. The options are **Show** which keeps your vmfs target in the search, **Only** which will only show vmfs archives and **Hide** which will exclude vmfs archives from the search.

- **Filter by Target Number** : this lets you filter by a backup target number (1 through 9) or set it to "%" which will search across all targets.
- **Filter by Backup Mode** : you can search for **All** backups, limit to just **Fulls** or just **Delta** archives.
- **Reset Filter** : This will erase any filter option values you have defined and reset them back to the esXpress defaults which show all backup archives.
- **Back** : saves your filter options
- **Quit to Last Menu** : quits and returns to the prior menu

Figure 19, esXpress Restore Menu – Filter

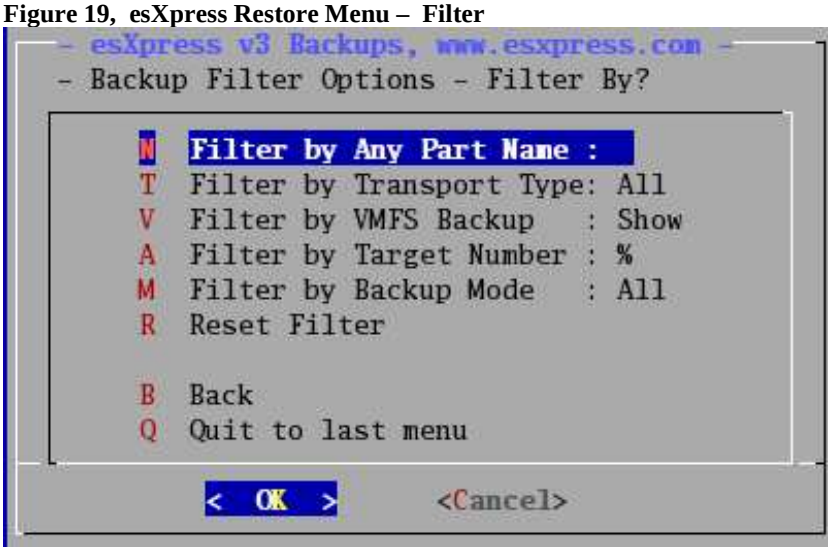
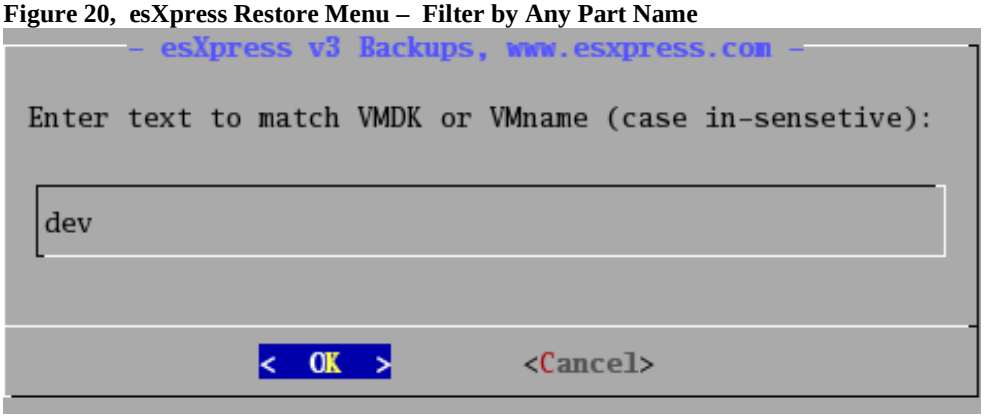


Figure 20, esXpress Restore Menu – Filter by Any Part Name



Checking the Status of Background Restore Jobs

Note – Background restores is a licensed feature.

From the **Restore Menu** select the **Background Restore Status** Option (*figure 22*).

Figure 22, esXpress Restore Menu

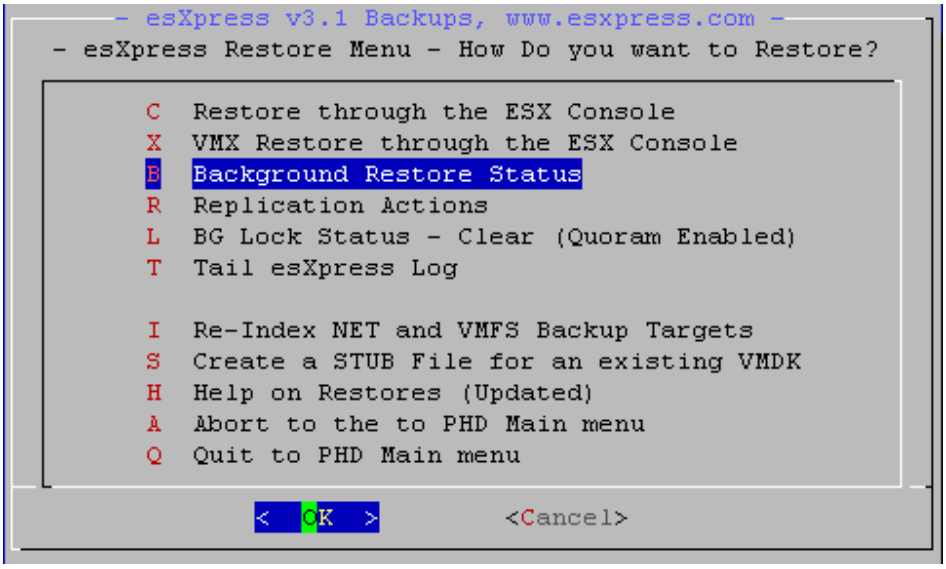


Figure 23, esXpress Restore Menu – Background Job Status Main Screen

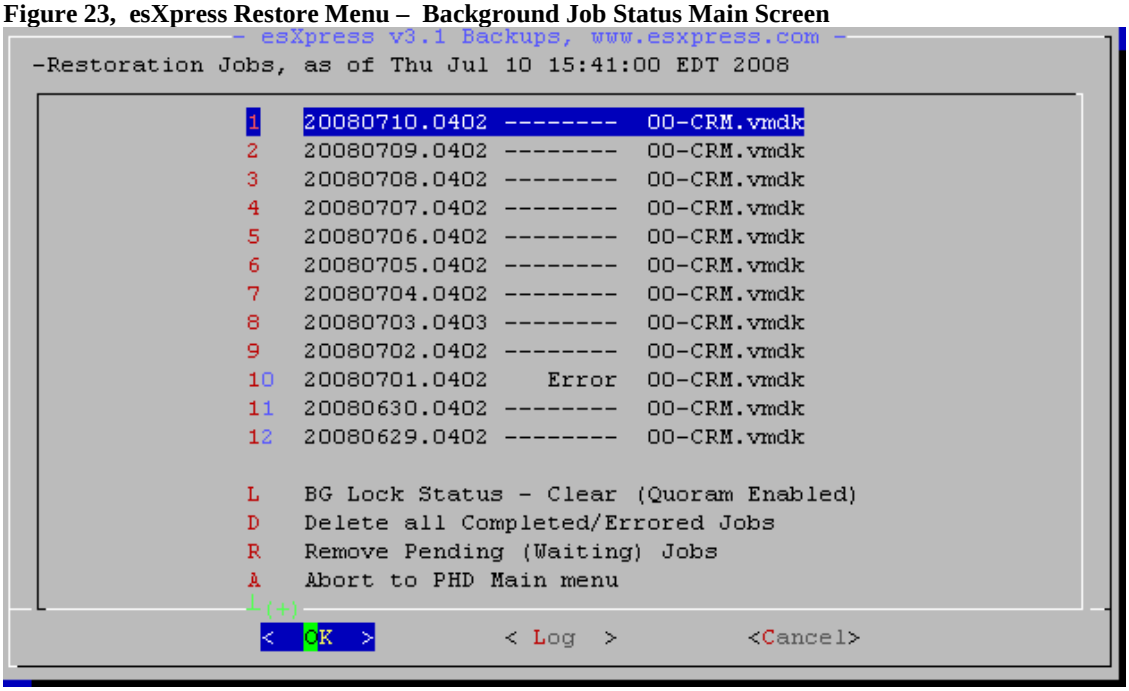
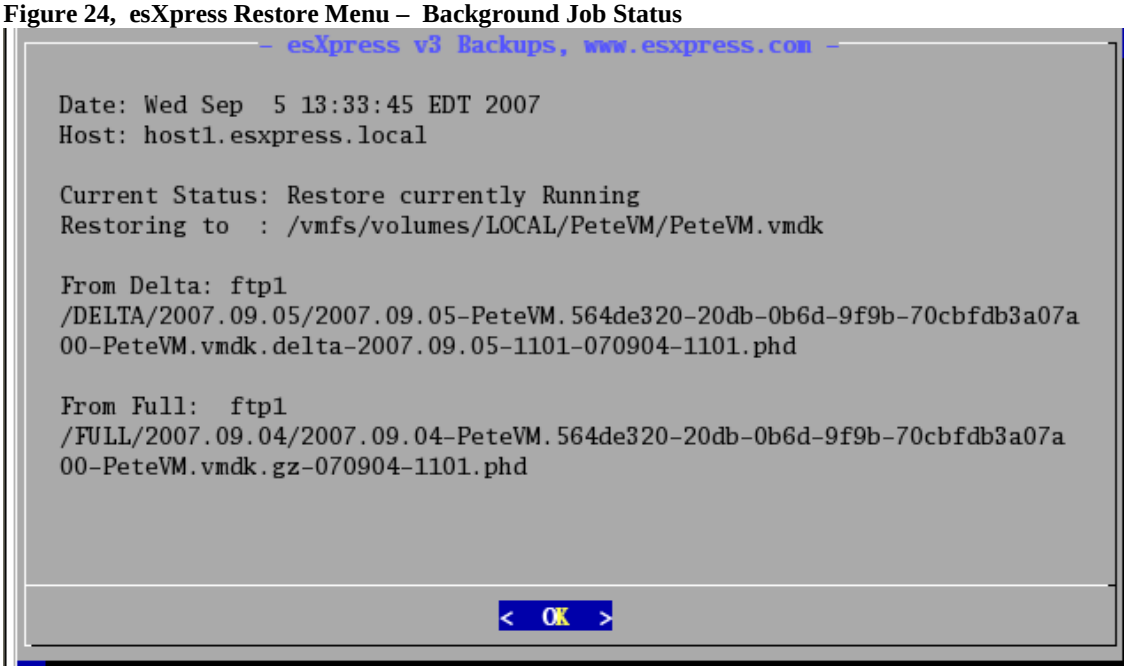


Figure 25 shows the current status of a Background Restore job.

Figure 24, esXpress Restore Menu – Background Job Status

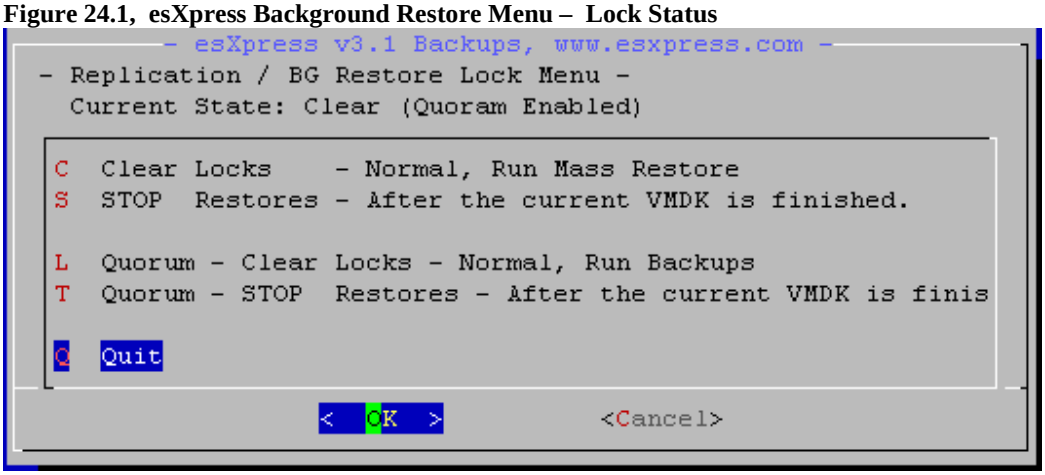


You can also view the running background restore log by highlighting < **Log** > and hitting enter. To exit the log hit *CTL-C*.

L – BG Lock Status –

This option works similar to the normal esXpress locks. You set and clear locks for background restores (*Figure 24.1*).

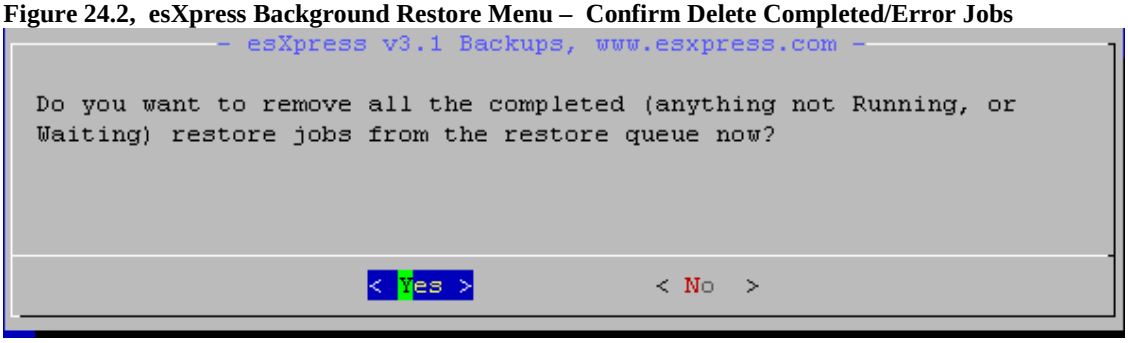
Figure 24.1, esXpress Background Restore Menu – Lock Status



D – Delete all Completed/Error Jobs –

This option can be used to clear out old background restore logs that you no longer need. It will remove all logs that completed, either restoring successfully or with an error.

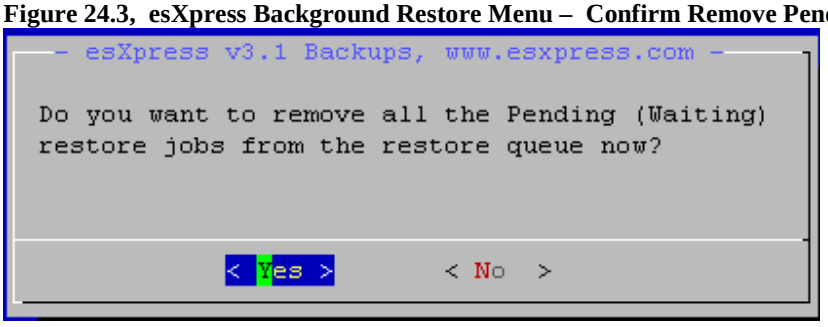
Figure 24.2, esXpress Background Restore Menu – Confirm Delete Completed/Error Jobs



R – Remove Pending (Waiting Jobs) –

If you need to cancel a pending background restore job you can use this option to remove that job.

Figure 24.3, esXpress Background Restore Menu – Confirm Remove Pending Jobs



A – Abort to PHD Main Menu – Selecting this option will bring you back to the Main PHD menu.

Restore Queue Readme

When esXpress does a restore, it can do it a number of ways. When you use the phd menu to restore a VMDK, you have the option to submit it to the restore queue. When you choose a Delta backup to restore, at the end you have the option of submitting it to the restore queue. Or you can run it in the foreground like esXpress has done until now (version 3.1).

(Always restore Delta backups over a Full backup. Restoring a Full might be faster, but when you restore a Delta backup it has many advantages. The VMDK will be pre-allocated and the backup imported into the VMDK. Each block of the Full and the Delta are compared against the index map to validate the checksum of all data. esXpress knows the proper name of the VMDK to restore.)

In the phd text menu, option (C) Replication / Restore Options menu under the (C) Configuration menu has the options for the restore queue.
--It needs to be enabled, it is by default.
--You can configure how many concurrent restore jobs to run at once. The default is 1, with a max of 4. Do not run 4 unless you increase the MHZ reserved for the console.

The restore queue is /etc/phd/restore
When backups are submitted for restore, a control file is created in this folder, then the phd_daemon will pick it up, and run the restore. If you define 2 restores to run, then 2 will run at a time. The log for each restore is also kept in this folder. From the Replication menu you have then option to clean-up and delete the restore jobs. (auto purging coming)

(Running 2 in a normal console is OK, but increasing console CPU Mhz will help keep the console from bogging down. Do not run more then 2 unless you increase the CPU allocation. But do experiment and test.)

From the (B) Backup Restore Status menu you can see the restore queue. It shows all the restore jobs in the /etc/phd/restore folder. The restore status for each is shown if it is complete, or Waiting to run. For each restore you can see who submitted the restore job, along with the log for each. If the restore is currently running you can watch the log as it runs. Remember to hit ^C (Control C) to exit the live viewer. When a backup is complete you can also view the log, this will use nano or vi.

The restore queue is only for Delta archive restores. It will not work for a Full backup. When a Full backup is made, an empty Delta backup is also made. The restore queue is also a licensed feature of esXpress. This means to auto replicate or mass restore, or for even background restore, you need a licensed copy of esXpress.

Automatic Mass Restorations of Virtual Machines

The Mass/Auto Restore or Simple Replication feature allows you to restore VMDKs very easily, which is very helpful when doing recovery. By only restoring a few VMDKs and doing it automatically, esXpress turns mass restores into simple replication. As of now, the mass restore will only restore delta backups.

The basic premise is that you have a list of VMDK names that you want to restore, and the name of the VMFS you want to restore them to. From either the PHD menu (manually) or automatically these VMDK files will be checked against the FTP servers, and the backups that meet the correct criteria will then be restored. Backups are matched by name, and you might get multiple matches, but only the first one will be used. Make sure to adequately test to ensure you are restoring the correct VMDK backups.

To restore a delta backup (which the mass restore uses) it must be downloaded to the local host first. Then the delta backup is run like a program. The delta backup will then pull the Full backup from the FTP on the fly and make a new VMDK file. The backup will be imported into the VMDK correctly (by creating or reusing the VMDK file). Afterwards the delta backup file will be deleted. Then the next VMDK file is processed and restored. **This entire process is automatic.** After you have defined the VMDK backups to restore, you initiate the process and watch.

Restoring Your Datacenter in 10 Easy Steps.

1. Start by restoring your backups from tape to a server.
2. On this server, enable the FTP service and configure.
3. Install the esXpress rpm on the ESX hosts and configure.
4. Choose option E for Restoration from the PHD Main Menu and then Option R for Replication Actions.
5. Choose option F ‘Load vmdks.auto file’ to import the VMDK list from FTP server or other backup targets defined.
6. Choose option E to edit the VMDK list, selecting the VM you want to restore and to which VMFS.
7. Choose option R to run mass restore.
8. Choose option B to check the status of the restoration of your VMDK files.
9. Choose option T to view the esXpress log file to check the status of the restoration.
10. Repeat steps 3-9 on the other ESX hosts.

Simple Replication/Mass Restore

esXpress defines 'Simple Replication' as *restoring of complete VMDK backups to a host or hosts automatically*. When you backup your virtual machines every day and restore them on another host automatically, you have achieved simple replication. Replication can be as often as hourly, or as little as once a day.

This feature is available in all licensed versions of esXpress. For hosts that only need to restore backups, and not create them, they can use esXpress LE to replicate their environment.

Default Options

- The original VMDK filename will be used.
- If the VMDK already exists, it will be overwritten.
- It will not be verified afterwards.

Note : The replication host level configuration options are discussed in detail in the esXpress v3.1 User's Manual.

Replication Actions Menu

All simple replication commands are handled using the Replication Action Menu. The menu is used on the **Replicated to Host**. From the **Restore Menu** select the **Replication Actions Menu** Option (*figure 30*).

Figure 24, esXpress Restore Menu – Replication Actions Menu

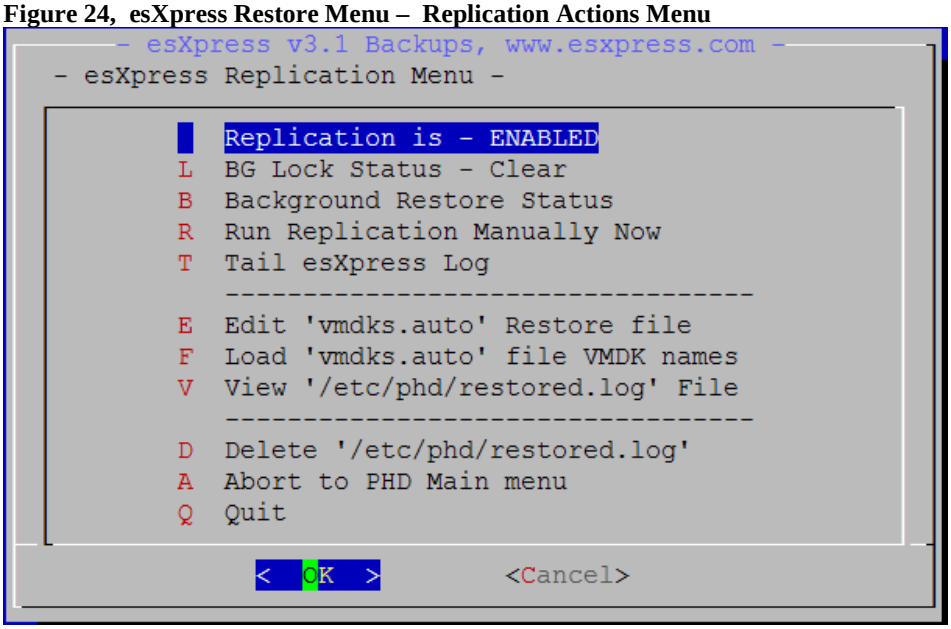


Table 10, esXpress Replication Actions Menu

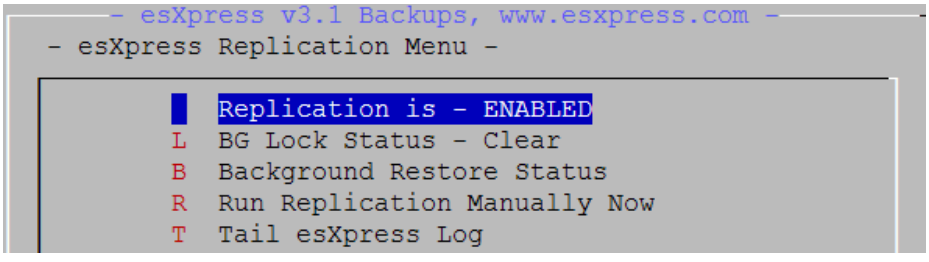
Option	Description	Function
	Replication is - XXXXXX	Shows current status of Replication ENABLED or DISABLE
L	BG Lock Status	
B	Background Restore Status	View statuses and logs of background restore jobs
R	Run Replication Manually Now	Initiate replication Now
T	Tail esXpress Log	View current esXpress main log
E	Edit 'vmdks.auto' Restore file	Edit the esXpress replication instructions file
F	Load 'vmdks.auto' file VMDK names	Load the replication file with distinct vmdk names from host
V	View '/etc/phd/restored.log'	View the listing of restored vmdks
A	Abort to PHD Main Menu	Returns to the PHD Main Menu
Q	Quit to the PHD Main Menu	Quit the PHD esXpress application.

L – BG Lock Status - <Current Status>

Just like the backups, the mass restoration uses lock files. You can set or clear the mass restore locks here. These locks do not affect backups, only mass restores.

From the Mass Restore menu, the line for **L – BG Lock Status**, is also an indicator for the current lock status. In the example below the status is 'Clear'.

Figure 25, Lock Status



The mass restore locks are currently checked before a restore is started. It will not cancel a currently running restore. Use the Kill option in conjunction with Locks to cancel out of mass restores.

Figure 26, Replication/ BG Restore Lock Menu

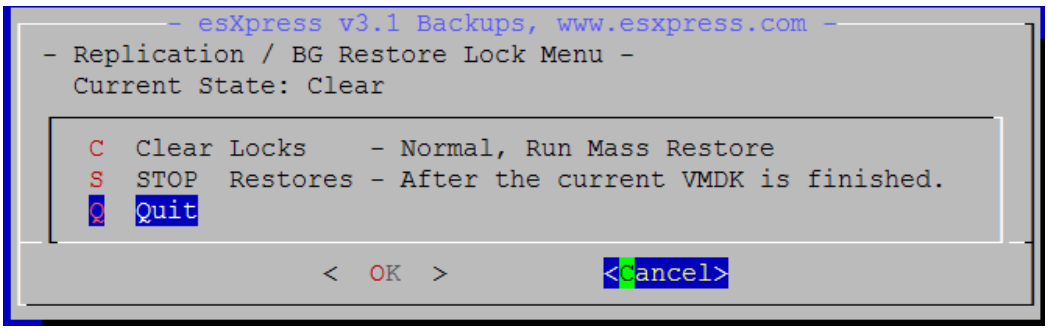


Table 3, Replication / BG Restore Locks

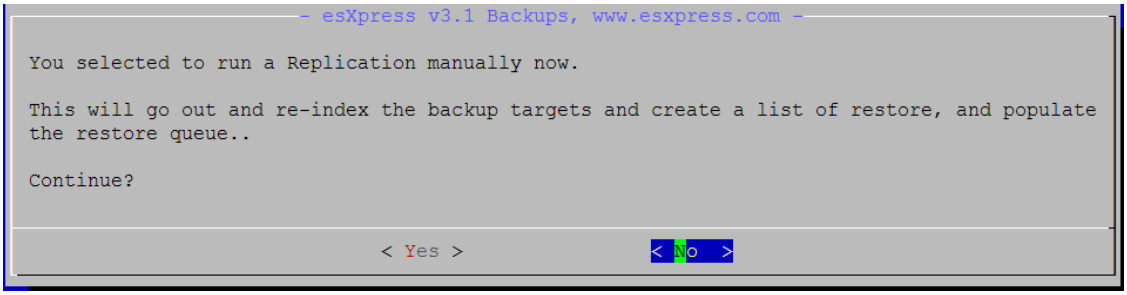
Option	Description	Function
C	Clear Locks	This will clear any Mass Restore Locks and enable restorations.
P	Stop Restores	The mass restore will be Stopped after the current VMDK is finished restoring.
Q	Quit	Quit this menu and return to the Replication menu.

,

R - Run Replication Manually Now

Now that you have configured the 'vmdks' files and ran the test restore a few times, its time to run the mass restore/replication for real. It's a good idea to run it from the menu here first before enabling auto-restorations/replication.

Figure 27, Run Manual Replication



E - Edit ‘vmdks’ Restore file

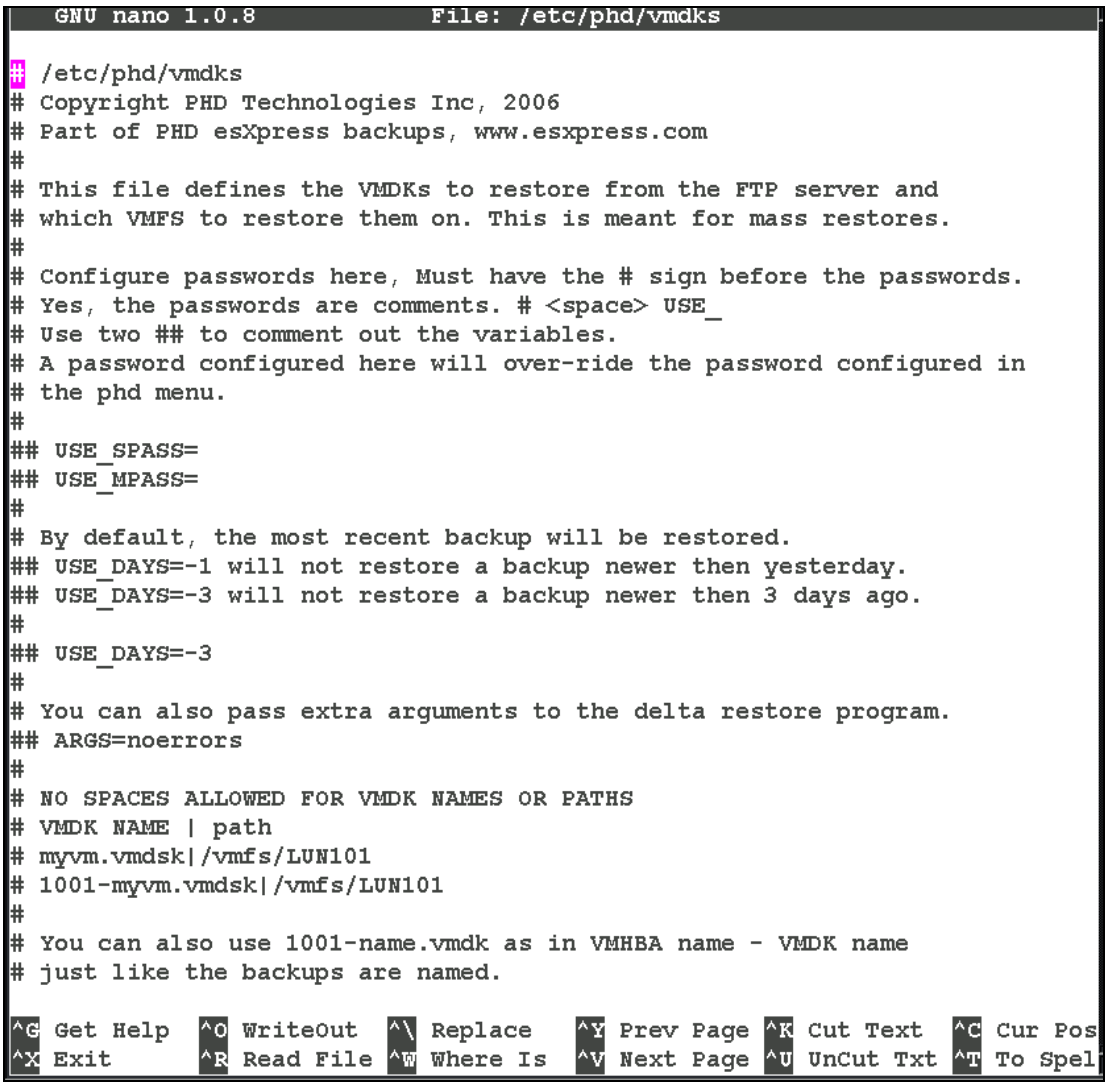
This file **/etc/phd/vmdks** is the instructions for the esXpress Mass Restore/Replication engine. It contains a list of VMDK files to restore and to which VMFS to restore them to. It also contains variables that control the behavior of the restorations.

Set variables **USE_SPASS** and **USE_MPASS** for the System and Master password you want to use when restoring the backups. You do not have to set both, but you can. Setting a password here will override the password in the Encryption Configuration (Page **Error! Bookmark not defined.**) menu. These variables must have the ‘#’ in front of them. They are comments in this file. But two ‘#’ as in ‘##’ means the variable will be ignored, commented out.

The variable **USE_DAYS** sets which day of backups you want to use. The default is zero or commented out (##). When set like this, the most recent backup on the FTP server will be used. Otherwise you want to set it for negative values. Minus One (-1) will restore yesterday’s backups. Minus Seven (-7) will only restore backups at least 7 days old.

Option **ARGS** is for passing extra arguments to the Delta backup. The option in the example above is ‘**noerrors**’. By default the restore program in the Delta backup will accept some checksum errors (10) before failing out of a restore. By enabling #**ARGS=noerrors**, you are telling the restorer to accept no errors.
Any error will cause it to fail.

Figure 28, Editing the 'vmdks' File

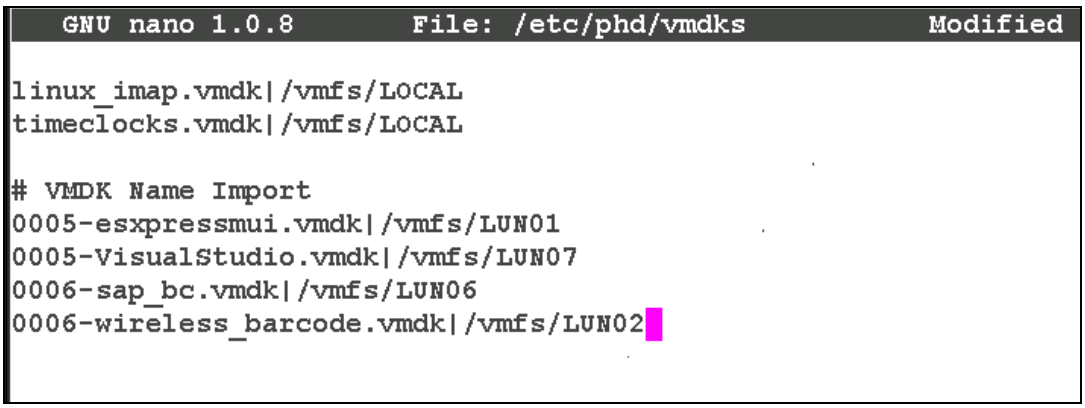


When entering the VMDK filename to restore, it can be in the VMHBA-Filename.vmdk or just Filename.vmdk notation. Use the VMHBA number to distinguish between different backup files. Hopefully your VMDKs are named in a way that they all have distinct names.

If the VMDK name has a '#' in front of it, then it is a comment and will be ignored. Remove the leading '#' to select a VMDK for restoration. After the VMDK name there is a pipe '|' followed by the name of the VMFS. Currently there cannot be any spaces used in the VMDK name or the VMFS name.

In the following example, linux_imap.vmdk will be restored to the /vmfs/LOCAL filesystem. Each VMDK file can be restored to a different VMFS.

Figure 29, VMDK Filenames to Restore

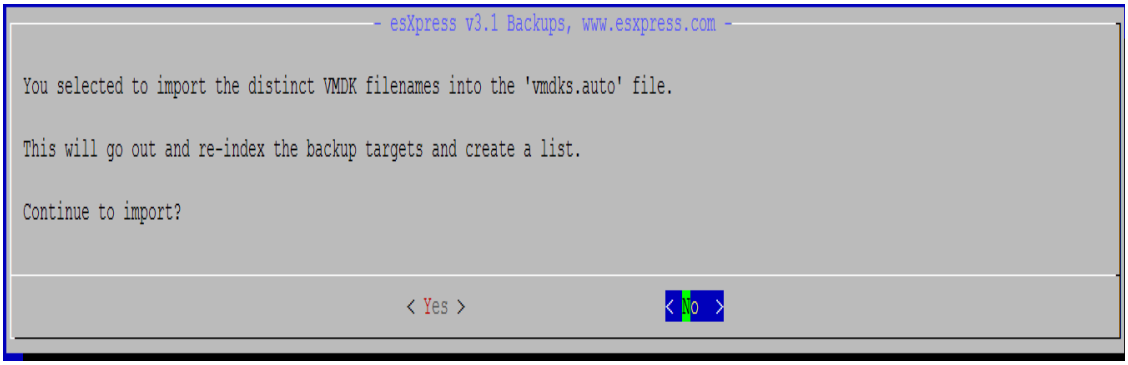


By editing this list of VMDK filenames, and making a list that you want to restore and where to restore them to, you can easily restore large numbers of VMDK backups with little effort.

F - Load ‘vmdks’ file with distinct VMDK filenames

When doing Mass Restores or Replication, the ‘**/etc/phd/vmdks’** file controls which VMDK files to restore and to what VMFS. By choosing this option ‘**F**’, a list of all distinct VMDK filenames will be loaded into the ‘vmdks’ file for you. Then you just need to edit it for the VMDKs you want restore.

Figure 30, Import VMDK Names



To get the distinct names, the following SQL is run against the FTP server database.

select distinct vmdk_name from ftp_database;

At the end of the ‘vmdks’ file, a list of VMDK filenames are appended. The name is based upon the Delta backup files on the FTP servers. The appended lines are commented

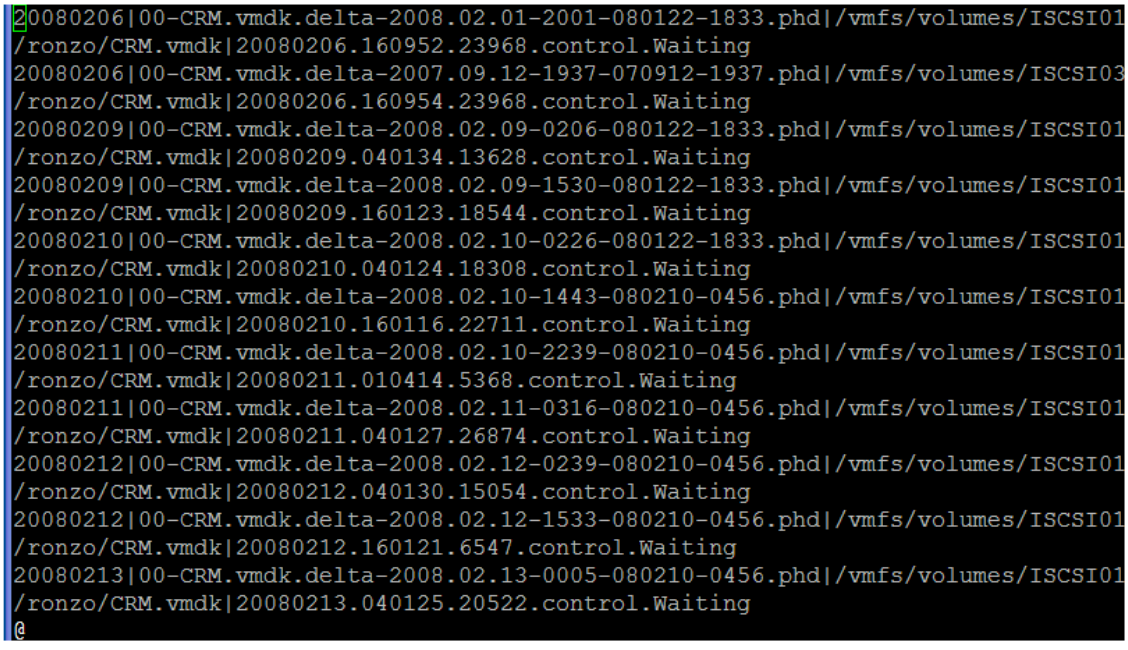
'#' out. Remove the '#' to use that VMDK. The VMFS name is defaulted only as **/vmfs/**, you must add the rest of the VMFS name.

VMDK Name Import
0005-esxpressmui.vmdk|/vmfs/
0005-VisualStudio.vmdk|/vmfs/
1001-dft01.dsk|/vmfs/
1001-dft02.dsk|/vmfs/
1101-oraforms00.vmdk|/vmfs/
1101-Genrad.vmdk|/vmfs/
0006-snapshots.vmdk|/vmfs/

V – View '/etc/phd/restored.log'

This option will show you the 'restored.log' which is a log of all the vmdks that have been restored through esXpress replication. *Figure 31* shows an example of this file.

Figure 31, View '/etc/phd/restored.log'

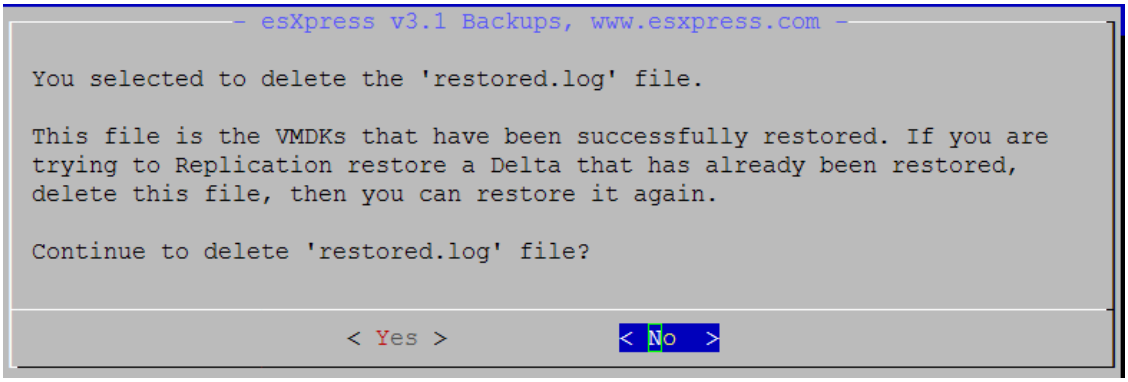


When viewing the restored.log, the only way to exit is to enter '**^C**' Control-C.

D – Delete '/etc/phd/restored.log'

This option will clear the restored.log file which is the log of all replicated vmdk's that have been restored. Clearing it will start esXpress replication in a fresh state with no vmdk's being marked as restores. *If you are trying to restore a Delta backup through replication that has already been restores, delete this file and you can restore that Delta backup again.*

Figure 32, Delete'/etc/phd/restored.log'



A – Abort to PHD Main Menu

Exits the Replication Actions menu and goes back to the Main PHD menu.

Appendix A

Simple Replication/Mass Restores Readme

PHD esXpress backups, Patent Pending
esXpress v3.1 Restores release README

by ron mckelvey, Sept 2007
This file is /home/phd/bin/RESTORES.txt
##
##
www.esxpress.com or backup.p2v.net

BASIC ESXPRESS TERMINOLOGY

-IN THE CONSOLE-
A console restore is simply the ability to restore a VMDK file or a VMX to the VMFS from within the VI3 console of a host. In esXpress v3 this function is the standard restore procedure. Currently to restore an esXpress v3 backup, you have to do it in the console, and not in a VBA.

We consider the ability to restores virtual machines in the console an important feature. If restores were limited to a VBA only, then you would not be able do any restores until your complete virtual framework was up and running. By enabling restores in the console, you are always provided the ability to restore your backups. We consider this a crucial DR feature.

A console restore is a menu driven text mode UI. You are walked through the complete restoration process of a VMDK file or a VMX file from beginning to end. Nothing more then hitting the 'Enter' key is usually required.

-SIMPLE REPLICATION-
If you were to take a backup, and restore it on another host, that is basically a restoration. If this happened automatically, then we could call it a replication of a Virtual Machine. This is how we define 'Simple Replication'.

-IN THE GUI-
Now that the restore queue has been implemented, GUI restores are coming.

-MANUAL RESTORES-
Above all, you should always be able to restore your backups. This is a simple statement, that we at PHD stand behind. With esXpress backups, you can always restore your backups, whether you have access to our software or not. With our product, only backups are licensed. There is no licensing involved with doing restorations. You own your data, not us.

-FULL BACKUPS-
When a FULL backup is made, it is just a gzip'd copy of the file-flat.vmdk file (gzip is the standard Linux compression utility). This file can easily be

restored to any version of VMware or even other virtual platforms. With VMware, you just need to make a STUB file, and you can use your FULL backup after unzipping it. Restoring a FULL is as simple as:

zcat fullbackup.gz.phd > newfile-flat.vmdk

-DELTA BACKUPS-
esXpress Delta backups are more then just backup files. The delta backup file itself it an executable program that will allow you to find and locate and combine the FULL and DELTA archives together to create the VMDK file.

Restoring a DELTA backup manually is fairly simple. If the DELTA and FULL backup are together on a share, you can just shell the archive.
Example: sh the_delta_file.phd

and a restore menu will appear. If the FULL is on the local share with the DELTA, then it should automatically find it. If not, you can tell it where it is, or even grab it on the fly from your FTP server.

Once in the DELTA Restore menu, you can perform many tasks including: restore a VMDK, verify the FULL archive, and a few others. This delta backup is scriptable. See the help in the restore menu itself.

THE ESXPRESS RESTORATION PROCESS

The way restores work in esXpress is different from most backup solutions. The backup and restore programs in esXpress are essentially 2 completely different applications. One does not have anything to do with the other. In fact the licensing for esXpress is only in the backup engine, not the restore programs. The Full backup is always restorable because it is nothing more then a gzip'd copy of the -flat.vmdk file. The Delta backup is actually a self restorable archive. It can restore itself without the need of the esXpress software. You own your backup archives, not us. You know with esXpress your backup archive are yours, and that you can always restore them, forever.

esXpress does not keep a grid or database of backups it has made like other products, but will connect and index the backup targets when needed. This way you can restore a FTP server, restore your backup tapes, and then have your VI3 hosts go out and index it. Then you can start doing restores. With the mass/auto restore you can setup numerous restore jobs at once, submit them to restore, and then watch it all restore automatically.

When choosing to restore a backup, the backup targets will probably need to be indexed unless they were recently indexed. If it's been more then 5 hours, then the targets will be re-indexed automatically for you.

Because of this indexing ability of esXpress, you can safely remove, move around or restore backups to a backup share. Then just re-index the share, and you can now restore your backups. It does not matter to esXpress if the delta is on the

local drive and the Full is somewhere else. As long as both the Delta and Full are included in the index of the backup targets.

As of 3.0-9 you can easily restore backups from version 2 of esXpress also. Just note, for the v2 backups, they will show up in the restore menu with their hostname as the VM Name. This is because the naming conventions used in version 2 of esXpress were different then those used in esXpress v3.

DELTA vs FULL RESTORE

When restoring backups, it is always better to restore a Delta backup over a Full backup, but a Full is faster. When a Delta backup is restored, esXpress knows the size of the VMDK. On restoration esXpress will create the VMDK file on the VMFS first, then import the backup into that pre-allocated VMDK file. This is the proper way to write to the VMFS. Because of this import, you can restore multiple VMDK files to the same VMFS at the same time.

If you are restoring a Full backup, it is restored as a plain file. It is no different then using the copy command or tar to write out the VMDK file. These methods do not pre-allocate the VMDK first, but write out the new file in chunks. If you were to copy multiple files to one VMFS at the same time, these files would effectively be interleaved. They would be severely fragmented.

If you still need to restore a Full backup, only do one at a time per VMFS, and you will be OK. If you do more, then they will be fragmented and performance can suffer in the running VMs.

When esXpress makes a Full backup, it always makes an empty delta too. The Delta backup contains the metadata information about the backup, along with VMX file and the index maps.

When esXpress Delta backups are restored, the restored file is checked, block by block on restoration against the index map. If there is a problem, then the restore will be aborted. If you were to lose a Full backup, and try to rename another one to replace it, it will not work. The checksums will not be the same and the restore process will be aborted.

ESXPRESS BACKGROUND RESTORE QUEUE

When esXpress does a restore, it can do it a number of ways. When you use the phd menu to restore a VMDK, you have the option to submit it to the restore queue. When you choose a Delta backup to restore, at the end you have the option of submitting it to the restore queue. Or you can run it in the foreground like esXpress has done until now (version 3.1). Note - Background Restores are a licensed feature of esXpress.

(Always restore Delta backups over a Full backup. Restoring a Full might be faster, but when you restore a Delta backup it has many advantages. The VMDK will be pre-allocated and the backup imported into the VMDK. Each block of the Full and the Delta are compared against the index map to validate the

checksum of all data. esXpress knows the proper name of the VMDK to restore.)

In the phd text menu, option (C) Replication / Restore Options menu under the (C) Configuration menu has the options for the restore queue.
--It needs to be enabled, it is by default.
--You can configure how many concurrent restore jobs to run at once. The default is 1, with a max of 4. Do not run 4 unless you increase the MHZ reserved for the console.

The restore queue is /etc/phd/restore
When backups are submitted for restore, a control file is created in this folder, then the phd_daemon will pick it up, and run the restore. If you define 2 restores to run, then 2 will run at a time. The log for each restore is also kept in this folder. From the Replication menu you have then option to clean-up and delete the restore jobs. (auto purging coming)

(Running 2 in a normal console is OK, but increasing console CPU Mhz will help keep the console from bogging down. Do not run more then 2 unless you increase the CPU allocation. But do experiment and test.)

From the (B) Backup Restore Status menu you can see the restore queue. It shows all the restore jobs in the /etc/phd/restore folder. The restore status for each is shown if it is complete, or Waiting to run. For each restore you can see who submitted the restore job, along with the log for each. If the restore is currently running you can watch the log as it runs. Remember to hit ^C (Control C) to exit the live viewer. When a backup is complete you can also view the log, this will use nano or vi.

The restore queue is only for Delta archive restores. It will not work for a Full backup. When a Full backup is made, an empty Delta backup is also made. The restore queue is also a licensed feature of esXpress. This means to auto replicate or mass restore, or for even background restore, you need a licensed copy of esXpress.

If you choose to restore a Full backup, it cannot be run by the restore queue in the background. You must run the restore in the foreground, on the console or through putty (ssh). This is how all esXpress restores were run until now (version 3.1, with the restore queue)

SIMPLE REPLICATION / MASS RESTORE

Simple replication is defined as having one Host backup to your Backup Target, then have others Hosts check the Backup Target and look for new Delta backups. When new backups are found they are automatically restored. This is what we call simple replication, even one to many replication.

Unlike other replication products, simple replication is included with esXpress. It is included at no additional charge, but does require a licensed copy. esXpress can only replicate from the available backups. This means you always have a copy on the backup server, in addition to the replicated copies. Other

products copy the data directly from one VM to another VM, with no backup.

HOW IT WORKS:
The default action is to look for the newest backups and restore them. But you can also define a VMDK as -3, this means restore one at least 3 days old instead. This way you can keep a copy of the Exchange server VMDK auto restored on another LUN, and a second copy from last week.

The Replication Actions are defined from the Restore Menu, which is item (E) from the phd Main Menu in the console. From the (R) 'Replication Action' menu you define the VMDKs you want to replicate, and manage the restore jobs. When the replication runs and chooses Delta backups to restore, they are submitted to the esXpress Restore Queue. Choose option (B) to manage the Backup Restore Queue.

All the options, the queue and log for restores are in the /etc/phd folder. /etc/phd/restore is the restore queue itself. Restores are submitted to this folder then processed by the background phd_daemon. This is enabled by default and requires the phd_daemon to be running. The restore queue is a licensed feature of esXpress.

/etc/phd/restored.log is a list of previously restored VMDKs. This file is checked after then Backup Targets have been indexed and compared against VMDKs defined in the /etc/phd/vmdks.auto file. If you delete this file or edit it, then you can restore a previously replicated restored backup.

/etc/phd/vmdks.auto is where the replication is configured. This is a simple text file describing with VMDKs to restore and where to restore them to.

You can edit the /etc/phd/vmdks.auto manually or from the phd menu. Option (E) in the Replication Menu. This file contains some example on how to configure the replication. You also pre-load this vmdks.auto file with a list of all known VMDKs on the backup targets. This is option (F) on the Replication Menu. Afterwards the Backup Targets will be indexed, and all unique VMDKs will be appended to the vmdks.auto file. Then you can easily edit this file, to include the VMDKs you want to restore. When each VMDK is loaded, it is defaulted to restore to the VMFS as defined in the (C) Replication / Restore Options in the (C) Configuration Menu.

The /etc/phd/vmdks.auto file looks like this:

```
## /etc/phd/vmdks
# Copyright PHD Technologies Inc, 2007
# Part of PHD esXpress backups, www.esxpress.com
#
# This file defines the VMDKs to restore and
# which VMFS to restore them on. This is meant for mass restores.
#
# By default, the most recent backup will be restored.
# USE_DAYS=-1 will not restore a backup newer then yesterday.
# USE_DAYS=-3 will not restore a backup newer then 3 days ago.
#
# USE_DAYS=-3
#
```

```
# You can also set the USE_DAYS value on a per VMDK basis instead of globally.
#
# UUID can be the correct UUID, or *, or % to accept
# any UUID where the VMDK name and the SCSI_ID match
#
# When the default restore path is created, it will use the VMFS defined in
# the Mass restore menu, off the Restore Menu.
#
#
RESTORE:VM_NAME|UUID_OF_VM|SCSI_ID|VMDK_NAME|Complete_Restore_Path|Use_
Days
#
RESTORE:CRM|564d122a-0ed7-3b92-2f46-
aee9456b2074|00|CRM.vmdk|/vmfs/volumes/ISCSI02/ronzo/CRM.vmdk
RESTORE:CRM|564d122a-0ed7-3b92-2f46-
aee9456b2074|00|CRM.vmdk|/vmfs/volumes/ISCSI02/caleb/CRM.vmdk|-3
```

The concept is that you define a list of VMs and VMDKs you want to mass restore or replicate. Every hour (or as defined) the backup targets will be re-indexed and matching backup archives will be matched against the /etc/phd/vmdks.auto file.

When defining which VMDKs for replication you need to know:
0. Line must start with RESTORE:
1. Which VM to restore. This is the folder where the VMX file lives.
2. Each VM is unique by the UUID, enter the UUID or * (For any). Be careful of DUPES.
3. The SCSI ID (or * For any) of the VMDK you want to restore. The backup archives are name 00- which mean SCSI ID 0:0
4. The Name of the VMDK you want to restore.
5. And the Full path to restore the VMDK to.
   This is usually /vmfs/volumes/some_vmfs/some_folder/machine.vmdk
6. Optionally, how many days behind the restore should be.
   If you make this -7, then only a backup at least 7 days old will be restored.

The example above showing CRM.vmdk is configured to restore the most current VMDK and a copy from 3 days ago. This allows you to backup one VM, and have multiple copies of it restored, for multiple purposes.

ON TO RESTORES FROM THE PHD MENU

From the (E) Restore Menu you can restore VMDK files and VMX files from within the console, and create STUB files if needed. Creation of STUB is not required but you may at time need to create a new STUB file.

Console restores are VMDK restores. You select the VMDKs you want to restore. If a VM as 4 VMDKs then you need to select and restore all 4 VMDKs for this VM.

To restore a VMDK you need to choose:
(C) Restore through the ESX Console

Then on the next menu you can search by VM Name or VMDK name. Or restore a VMX file. After a Delta backup is restored, you are asked to restore the VMX file at that time. The restore VMX option is here incase you just want to restore a VMX only.

Choose: (V) Select by Virtual Machine name

Now you should get a list of all known VMs. The VM name here is from the folder on the backup target. The folder name on the backup target is based on the date of the backup and the original folder name of the VM from the ESX host where the backup came from. Version 2 backups will show up here by host name, not VM name.

If you choose (F) Select by VMDK name, then a list of all unique VMDK name are shown.

Sometimes these menus can have a lot of choices, and moving around the menu can be tiresome. Some quick keys to remember. If you hit (B) or (Q) you will jump to the bottom, and pressing (1) will bring you back to the top.

SELECT A BACKUP TO RESTORE

Once you select a VM and press enter, you are shown a list of all dates for this VM. This is all the backup archives found on the backup targets. Choose a date or All Dates. Then the backups that match this VM name are shown. This will include all VMDKs that match this VM name. Be warned, if you have the same VM name on different hosts, they will show up here together.

For each backup listed, you are told from which target it was found, the size, the type of backup (Full/Delta), the date, the SCSI ID and the VMDK name. You can choose the Filter option and filter the output by various ways.

Once you select a VMDK to restore, you are then shown a summary of what you want to do. Here you are shown the full path to the backup file and the backup target information. Once you select to continue, the connection is checked to make sure the backup can be successfully accessed. This can a few seconds as the header for each backup is actually downloaded and verified.

If this is a Delta restore, then you are asked to choose which Full backup to use. If the Delta backup file you choose has a UUID then esXpress will show with an asterisk '*' next to the Full backup it thinks is correct by a matching UUID. If you choose the wrong Full backup because you have Dupe VM names, then the restore will be aborted because esXpress will know it is not correct when it validates the blocks on restore.

You could be shown multiple Full backups that match the Delta you are restoring. If you were backing up to VMFS and NET, you have two Fulls, and both will be shown on the restore menu.

SELECT WHERE TO RESTORE

After the connection to the Full and Delta have been verified, you are now asked where to restore this backup to. You are shown a list of where this VMDK file currently exists and the option to restore elsewhere.

Warning, if your VMFS Nice names have funny characters in them, then esXpress is not happy. Instead of ISO's, use ISOs. The single quote is a problem at this time. Other characters may cause issues too.

You can either choose to over-write an existing VMDK file or choose a new path location. If you choose to over-write, then that VM has to be powered off. If the VM is running, and then selecting it will not hurt it, as esXpress will tell you that it can not select that location because it cannot get a write lock.

Once you choose a location, you are asked to name the VMDK. esXpress will suggest a name. If you are restoring a Delta, then esXpress knows the name. If it is a Full backup then esXpress can only guess at what the name should be.

AND THE RESTORE IS STARTED

You are asked for a final verify before starting.
Once you select to continue you are asked if you want to submit this restore job to the background restore queue. Saying 'Yes' will add this restore job to the queue. You can keep submitting jobs to the restore queue and they will be run in order. For this example we selected 'No' to submit to the restore queue.

The restore is started in the foreground. Do not close a putty window if you are running a restore in the foreground. Your restore will probably die and the esXpress process might now properly clean-up leftover files.

If you are doing a Full, then the restore starts and you are shown a status of how much and how fast. When restoring the Full, esXpress is literally grabbing the file from FTP/SSH and passing through gzip and writing the file out.
(Make sure you read Delta Restores vs Full Restores above)

A Full restore.
---
esXpress v3.1, Doing FULL Backup Restoration, www.esxpress.com

Restore FULL Backup from
Location: 192.168.201.2:21/local/esxpress/backups
Folder : 2007.09.20-CRM.564d122a-0ed7-3b92-2f46-aee9456b2074
File : 00-CRM.vmdk.gz-070920-1601.phd

Restore to:
VMFS: /ISCSI02/ronzo
VMDK: CRM.vmdk
FLAT: CRM-flat.vmdk

Restoring FULL Backup from NET FTP Target
405 MB processed Avg(15.0 MB/s) Cur(13.7 MB/s)

If you are restoring a Delta backup, the process is a little more involved internally. The Delta backup needs to be downloaded to the local VMFS first. Then the Delta backup is executed like a program, which then pulls the Full and makes the new VMDK file on the fly. When the delta is being restored you are shown real stats on how much, what percent, how fast and how much time remaining.

Delta: 67% Full: 32%, 1300 mb of 4096 mb, at 11 meg/sec, Elapsed: 01:50s Remain: 04:14s

When restoring a Delta archive, the VMDK is pre-created on the VMFS first using vmkfstools. Then the restore is imported into the existing VMDK. Because the Delta is importing the backup into the VMFS, and it is validating the data of the Full and the Delta blocks against the index maps, it is not as fast as a Full restore. When the data blocks are verified on restore, any bad data will cause the restore to abort. Even one flipped bit will cause it to abort.

After the Delta restore is complete, you are asked if you want to restore the VMX file also. When you restore the VMX file it is the copy form when the backup was made. If you restored to a different path and setting, you must check the configuration of this restore VMX in the VI3 client. esXpress will not edit or update the VMX to reflect changes you made on restore. You must do this yourself from the VI3 client

Afterwards the Delta backup file is removed, but only if it was downloaded. Delta backups on the VMFS as a backup target will not be deleted.

If you want to test the DR ability of esXpress you can simply run the delta backup file on your backup host and restore a backup there. You do this by 'sh the_delta_archive.phd' and a restore menu will be shown. If your backup host is a Windows server, you just need install Cygwin first and you can run the self restoring Delta archive. (Install Perl and Lynx too with Cygwin).

The Delta backup is a run-able Linux program that will use the Full backup and recreate the VMDK file. No additional software is required. To restore an esXpress delta backup on any Linux or ESX host, without the esXpress software, you need to only: sh (the delta file)

Example: sh 00-Win2K3.vmdk.delta-2007.01.29-0220-070124-2111.phd

Then the delta restore menu will be shown. From this menu you can restore the backup or just validate it. This is how Delta backups are restored. Once the Delta has been downloaded, the delta file is then executed by the phd menu.

The restoration of the Delta files can also be scripted easily!

```
##########################################################################
##
##########################################################################
##
##########################################################################
##
```

Simple Replication Example

- Our example VMDK **email.vmdk** is backed up at 00:01 hours when the nightly backup runs on ESX01. It is completed before 01:00 hours.
- Now on ESX02 at 01:01 hours the FTP server is checked for new backups, it finds our example **email.vmdk** and it is then download and restored to the local host.
- On ESX03 we have configured the **USE_DAYS** (in the vmdks file) variable to '**–2'**. Because of this, the newest backup on the FTP server is not used. By setting '**-2**' we are telling mass restore not to restore backups that are newer then 2 days ago. It will restore the latest backup that was made 2 days ago.
- Come 02:01 hours, ESX02 and ESX03 will both index and check the FTP servers for new backups. If none are found, then nothing is done. This happens every hour. If a mass restore (replication restore) is currently running, a new one will not start up. Only one automatic restore will run at a time.
- At 12:01AM the VMDK **email.vmdk** is being backed up again on ESX01.
- Its 13:01 and ESX02 checks the FTP servers and find a new copy of **email.vmdk** and restores it.
- ESX03 at 13:01 hours would check the FTP server again, but do nothing else, as it has already restored the latest backup from 2 days ago.
- This continues on forever until you disable it.

In the previous example we did a simple one to many replication, including having one host be 2 days behind; just in case.

Complex Simple Replication Examples

- At Location #1 you have ESX farm #1 backing up to FTP Server #1.
- You could have hosts in farm #2 (also at Location #1) replicating VMDKs from FTP Server #1.
- Now you also have a Location #2. The ESX hosts here could replicate from the FTP Server #1 across the WAN.
- Instead of having the hosts at Location #2 pulling the backups from FTP Server #1 across the WAN, you could replicate the FTP Server to Location #2. There are numerous ways to do this.
    - If your FTP server has a SAN backend you could use the SAN to replicate the backups from one location to another.

- If your FTP server is Windows you could use something as simple as RoboCopy to copy the backups from one location to another.
- If you FTP servers are Linux or UNIX you could use rsync to replicate the backup servers.
- Or any other method.

By copying backups from one backup server to another, whether it's in the local datacenter or across the world, you can achieve simple datacenter replication when using esXpress.

Example Scenarios

Have your Exchange server replicated to another host. In case you need to recover a mailbox, it's a lot easier to bring up the replicated copy of your Exchange server on host only network and exmerge the users mailbox or public folders. Then move them back to the real Exchange VM and exmerge them back in.

Have 2 different hosts replicating your main File share. Have host #1 restoring last nights backup, while host #2 is a week behind.

Appendix B

Known Issues

Opteron CPUs and Checksum Errors

Occasionally checksum errors may occur while doing a restore. When verifying Delta blocks or performing a restoration, which also verifies the delta blocks, esXpress may detect that a checksum does not match. The Delta blocks are checked against the Delta Index that was made during the first stage of the Delta Backup.

If backups are being made and restored on Intel based hosts, a checksum error indicates the archive is invalid. Otherwise, if an AMD Opteron platform, the error is most likely due to the “Opteron Bug”, when in a tight loop performing repetitious mathematical functions, sometimes the CPU will “flip a bit”.

This is a very tight loop that computes the checksums. For a 10 GB file it would loop 40,000 times doing the same checksum calc routine, over and over again. The “Opteron Bug”.

In proving this, we start with a 10GB VMDK file. Then on an Intel based host we compute the md5 checksum for each 256k block of data, or 40,000 total. Then on an Opteron based host, using the same VMDK file, we perform the same task, comparing the checksum to the control list. Very often, the system would report a checksum that did not match, even though the file is verified valid. This test is repeatable with predictable results.

Doesn’t this checksum affect my backup? No. The problem esXpress detects is that a Delta Block does not match its checksum value. The value of the checksum is incorrect, but the data in the Delta block is correct.

Appendix C

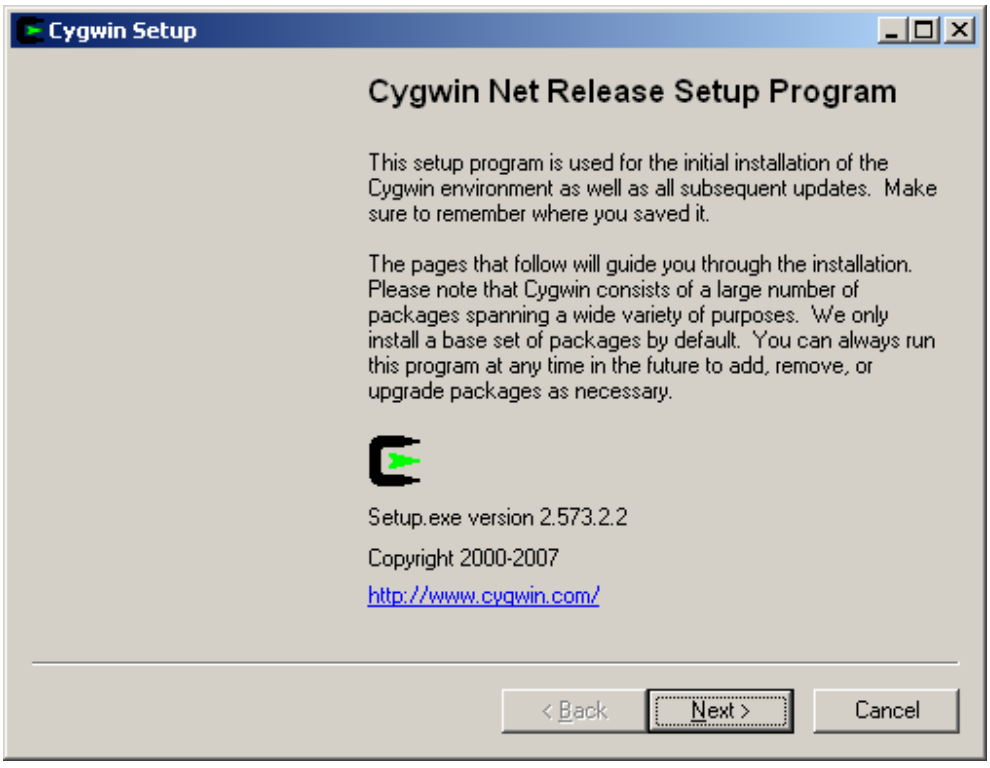
Installation of CYGWIN

To start you will need the CYGWIN installation package which can be downloaded at http://www.cygwin.com.

Create a folder named ***cygwin*** in the root of your C: drive and download the CYGWIN installer into that folder.

Next, run the installer by double clicking the setup.exe that you just downloaded. The installation menu will open, select ***Next*** to continue.

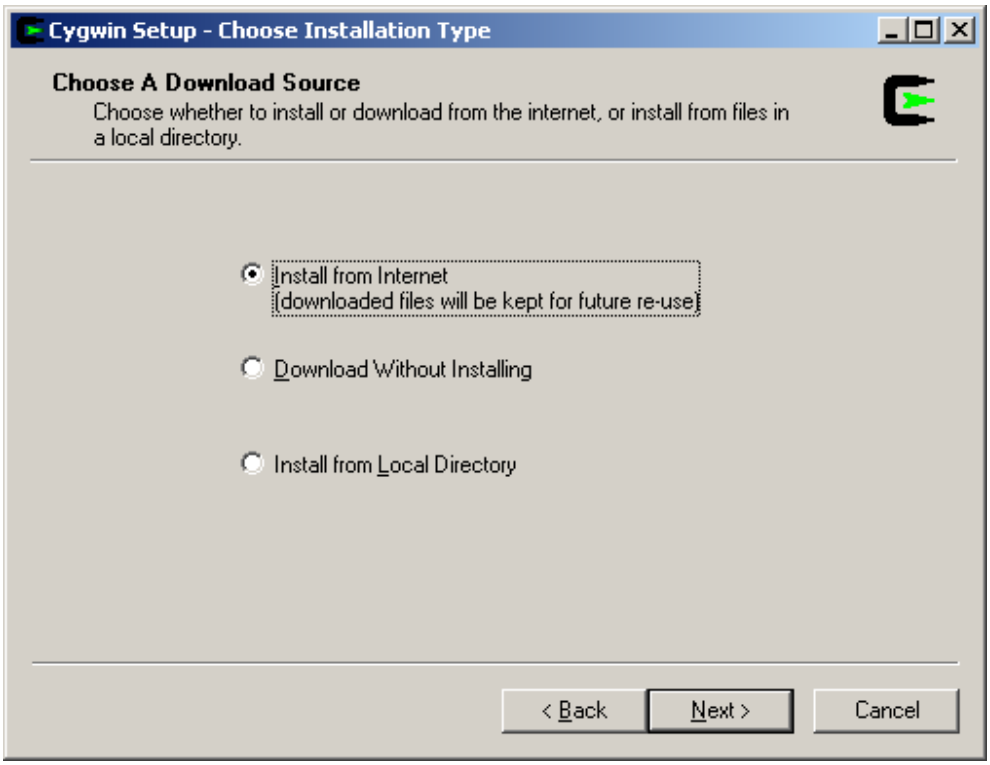
Figure 4, Cygwin Main Menu



Next you are prompted to select a download source. This manual assumes the server you are installing to has access to the Internet.

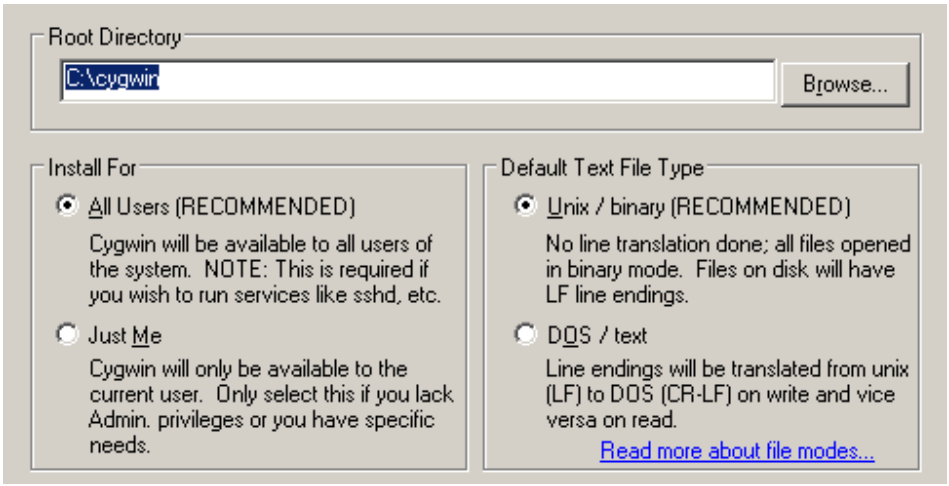
When prompted to "*Choose A Download source*", select "*Install from Internet*".

Figure 2, Choose A Download Source



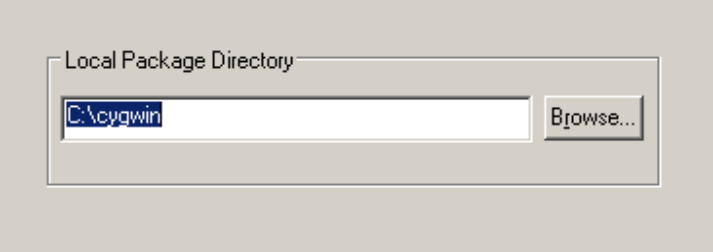
Next, select the directory to install Cygwin, or accept the default selection. Ensure that the "*Install For All Users*" radio button is selected as well as the "*Default Text File Type Unix / binary*" is selected as well.

Figure 3, Cygwin root directory



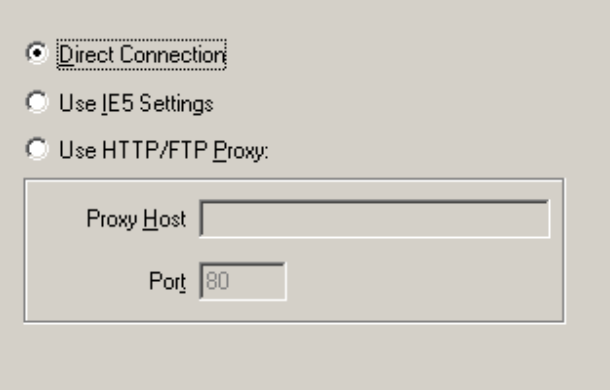
Next you are prompted for the "*Local Package Directory*". Select the same directory as you did for the Cygwin installation.

Figure 4, Local Package Directory



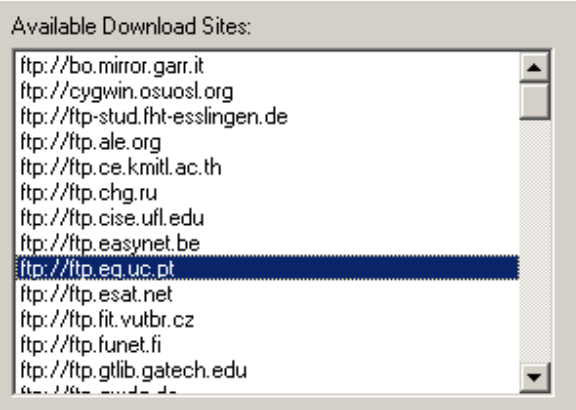
The next prompt requires you to specify how the application should connect to the Internet. Select the option that applies to your environment.

Figure 5, Internet Connection Method



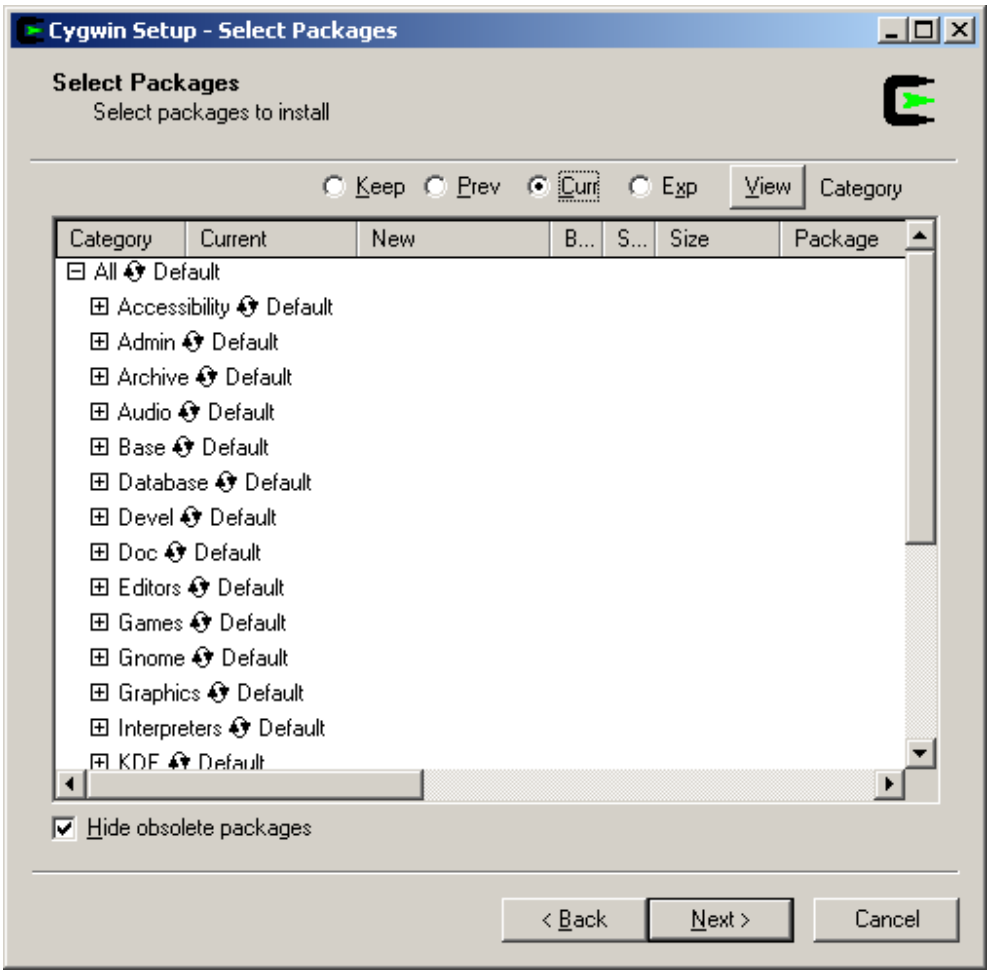
At this point you are prompted to *Choose A Download Site*. For the best download speeds, try to select a site that is located within your country or region.

Figure 6, Choose A Download Site



The installation now requires you to select the desired packages. In addition to the default selections we will need to select additional packages for use with esXpress.

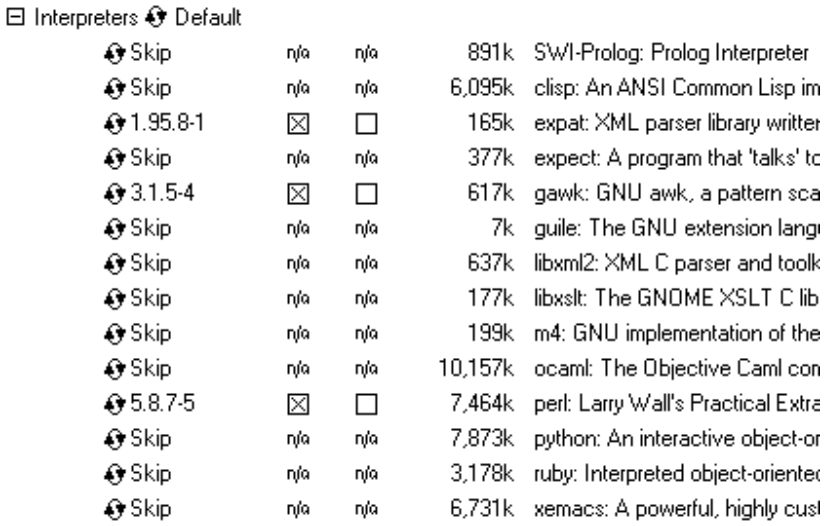
Figure 6, Select Packages



Scroll the window until you see the *Interpreters* section. Click on its preceding plus sign to expand the installation options for this section.

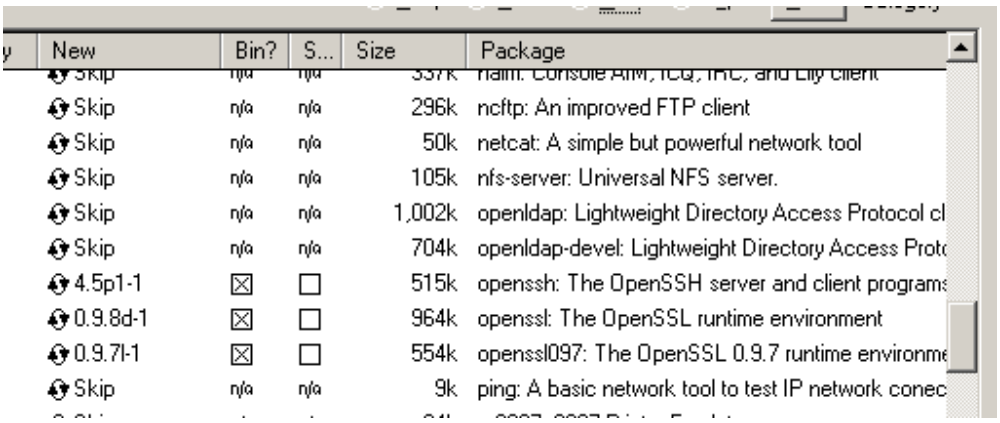
Here we can select the additional Interpreters. Make sure to select the following; expat: XML parser library, gawk: GNU awk, and perl: Practical Extracting and Reporting Language.

Figure 7, Interpreters



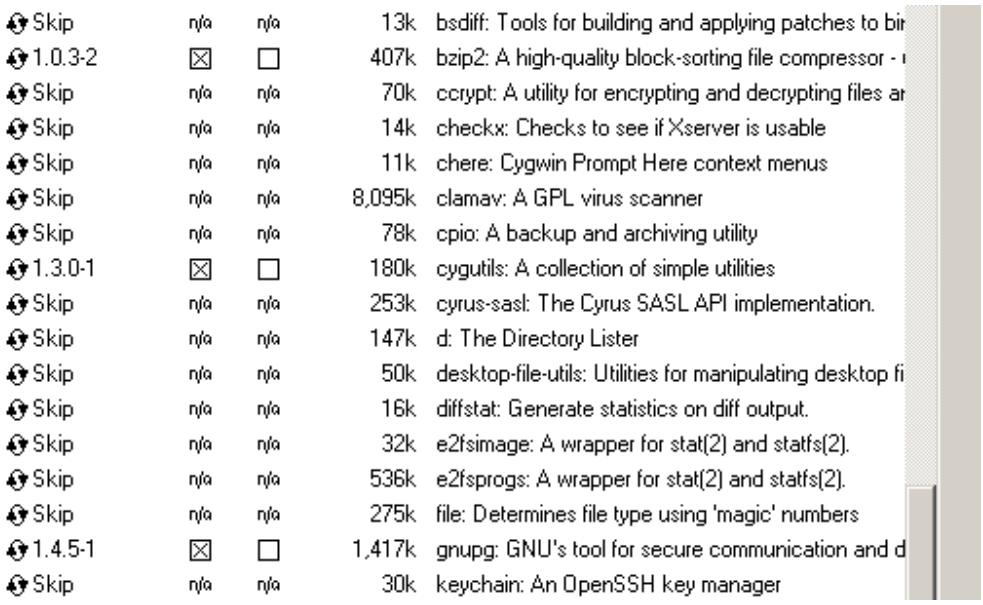
Now, scroll the window until you see the *Net* section. From this section, select *openssh*. This will automatically select *openssl* as well.

Figure 8, Nets



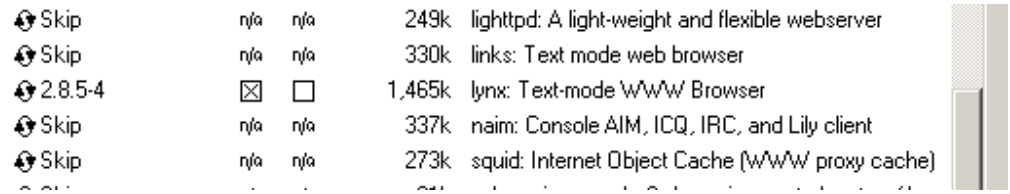
Scroll the window again until you see the *Utils* section. From this section, select *bzip2, cygutils,* and *gnupg*.

Figure 9, Utils



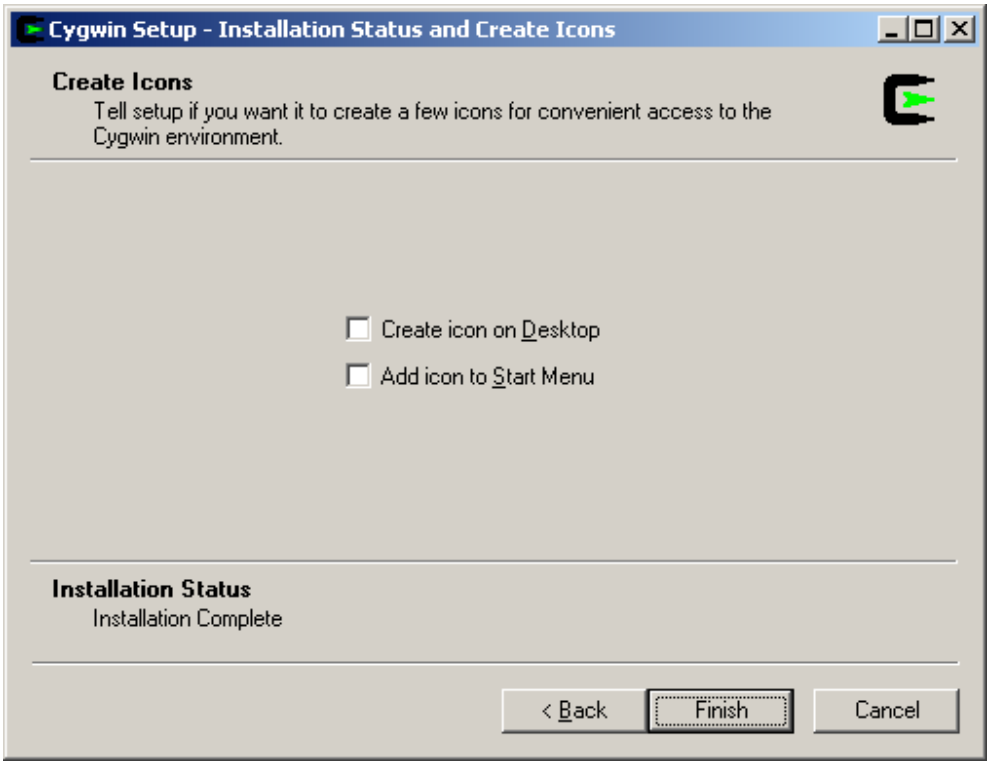
And finally, scroll to and select the *Web* section. Make sure to select *lynx: Text-mode WWW browser*.

Figure 10, Web



And last, select whether or not you want the *Cygwin* icon created on the desktop and start menu.

Figure 11, Create Icons



Installation is complete. Press OK.

Figure 12, Installation Complete

Appendix D

FAQ

Q: Can I restore my esXpress backup on my Linux backup server?
A: Yes, the delta backup file is actually a Linux program, you can run it on any Linux host. Because of this, you do not need our esXpress software to do recovery. Not only can you rebuild the VMDK file on your Linux machine, but you can use the VMDK directly with VMware Server (or GSX) on that Linux machine. With a helper machine you can mount backup copies of VMDKs and easily recover files or data.

Q: Can I restore my esXpress backups in Windows?
A: Yes, (See Previous Question) With the CYGWIN environment installed on your Windows server you can execute the backup file just like it was Linux and restore your backups. This includes encryption. This way on your Windows FTP server you can restore a VMDK backup, and use it directly in Windows with VMware Server

Q: When I try to run the 'phd' menu or go to a different menu item, nothing happens, the screen just flashes.
A: You probably are using a terminal program (such as Putty) and have your window too small. The menu requires a minimum screen size equal to the console (80 x 24 characters).

Q: How do I know what my maximum FTP speed is?
A: You can test your FTP speed from the '**C**' Configuration Menu. Select Option '**F**' for the FTP server configuration menu. Then select option '**D**' Do FTP Speed Test. This test will send a 200 meg file of NULLS to the FTP server. It will give you the maximum speed you can achieve through FTP. This speed is based on the console NIC, the network, the ftp server NIC and writes speed. If this speed test is not positive, if you are achieving less then a couple of meg a second, then you have a problem. Check your FTP server, is it out of space? Is your NIC duplex ok? Are you getting switch errors?

Q: My NIC is only 100MB, would using Gigabit be better?
A: Yes, you will get faster backup speeds on a gigabit NIC

Q: When I run the FTP Test it does not work, but the FTP Speed test is successful. Why?
A: The FTP test and FTP Speed are 2 different FTP methods that are both used to make backups. Try using the IP Address instead of the DNS name for the FTP server.
Make sure the FTP user has full permissions on the FTP path, on the FTP server. It needs to mkdir, write, rename, dir, delete, full control.
Make sure you enter a path for the FTP Folder. If you leave it blank, it will not work.

If you are using a **Domain\User** for the FTP user, you must enter it as '**Domain\\User**', but only one '\' will show after hitting enter. (Because Linux is eating the first \).

Q: I use IIS for my FTP server, and when I restore small VMDK files everything works fine, but when I restore large ones, there is always an ERROR.

A: IIS is not a robust FTP server. When you send large backup archives, we have seen IIS pretend to complete the backup, but instead actually truncates the file. When restoring from IIS, often it will refuse to download files larger than 4GB. We have also seen it just timeout on the ftp transmission, even though it is actively writing and the backup file is growing in size (on the FTP server). IIS is definitely not a commercial quality product and we highly discourage its use. There are many third-party FTP servers available for Windows with Filezilla being both free and stable.

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