Review
What's So Special
About
*Backup**EDGE**™ 3.x*?

Reviewer's Guide To Microlite *BackupEDGE*

Microlite *Backup**EDGE*** 03.05.02

What Is *BackupEDGE*?

*Backup**EDGE*** is a high performance, easy to use, **fully integrated** backup, restore and recovery software product for UNIX® and Linux® operating systems. It manages the entire *process* of protecting critical data, while shielding the user from the headaches involved in directly managing individual *actions*. It does this with a modular architecture providing great flexibility in implementing and maintaining backup strategies.

It uses a modern, standards-based data format that allows for very long pathnames, very high compression ratios, multiple archive verification strategies and highly secure data encryption.

*Backup**EDGE*** supports the industry's widest variety of storage devices, including cloud storage, network-attached storage, D2D storage (flash drives, removable disk, etc. in addition to legacy formats such as optical media and tape drives, including libraries and changers.

Cloud storage supports major vendors such as Amazon S3, Google Cloud Storage, and Wasabi.

What Does "Backup" Mean?

Understanding what "Backup" means is the key to understanding how *Backup**EDGE*** works.

Data protection in a production environment is a *process*, only a small part of which is the single *action* of copying data from one storage system to another.

In its simplest form, a backup means "take this data and make a copy of it over there for safety". This is the method used by the Linux® and UNIX® **tar**, **cpio**, and **dump** commands for years: data (in the form of individual files) is copied to a tape, and can be restored from a tape. There is no notification or summary of results, no easy way to schedule backups regularly, and rarely any way to verify that the operation actually worked. To these programs, a backup is an *action*: that of copying data.

This works well, as long as your backup strategy is simple, your data is easy to access, your storage device is "guaranteed" reliable, and there is an appropriate driver available for your device. Unfortunately, these assumptions are far too restrictive for most production environments.

Ultimately, anything that does a backup must "copy ... it over there", at some level. However, that is only the **beginning** of what the average system administrator needs to protect the data in his or her care. To be truly useful, a backup solution must allow easy management of <u>what</u> data is copied, <u>when</u> it is copied, and <u>to what device</u> it is sent. It must be able to <u>transform</u> the archived data when necessary for space savings (compression) or security (encryption). It must determine, reliably, the <u>success</u> or <u>failure</u> of the copy operation, and produce <u>reports</u> on the results. It must provide a clear path to <u>restoring</u> that data later, with a minimum of fuss or hassle.

Microlite Corporation
2315 Mill Street
Aliquippa PA 15001-2228 USA
Tel: 724-375-6711

email:sales@microlite.com
web: www.microlite.com

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In short, protecting data in a production environment is a *process*, only a small part of which is the single *action* of copying data from one storage system to another.

What Is *RecoverEDGE*?

Effective bare metal disaster recovery means never having to start a re-install from scratch. Microlite products have had disaster recovery since the 1980s.

*Recover**EDGE***™ is automated bare metal disaster recovery (DR) software allowing complete recovery after a hardware failure without having to re-install the operating system, configure device drivers, etc. It comes free with the Linux, UnixWare® 7, OpenServer™ 6 and OpenServer 5 versions of *Backup**EDGE***.

Both *Backup**EDGE*** and *Recover**EDGE*** contain many features that are either not available in competitively priced products, or available but with reduced feature sets. This guide describes some of the advanced features, and how to evaluate them.

** The mark at the left indicates a suggested action for the reviewer.

Let's divide the capabilities of *Backup**EDGE*** into sections and discuss each individually...

Backup and Restore Component (*Backup**EDGE***)

- What *Backup**EDGE*** is NOT
- Backup Data Format
- Data Encryption
- Enhanced Software Compression
- Data Integrity Verification
- Installation and Setup
- Operating System Integration
- Product Removal
- User Interface
- Job Scheduler
- Disk-to-Anything-to-Anything Backups
- MySQL™ Hot Backups
- Advanced Notification
- Fast File Restore - Quick File Access for tape
- Instant File Restore™ - Optical Media, NAS, HD, Cloud
- Device Control and Support for Changers, Autoloaders and Libraries
- Network Attached Storage (FTP/FTPS/NFS/SMB/CIFS Backups)
- Cloud Backups
- Hard Disk / Cartridge / Flash Media Backups
- Command Line Interface Support
- TapeAlert™
- Special Application Support
- Update Manager
- Non-Profit / Charity Licenses

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Aliquippa PA 15001-2228 USA
Tel: 724-375-6711

email:sales@microlite.com
web: www.microlite.com

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Disaster Recovery Component (*Recover**EDGE***™)

- Boot Media Creation
- Fully Networkable
- Remote Administration over network or even modem
- OneTouch Restore™
- Compatibility

BackupEDGE Features

What BackupEDGE is NOT

*Backup**EDGE*** is **not** simply a replacement for the tools, such as *tar* and *cpio*, that come with every vendor's base operating system. These tools perform *actions* on demand. To integrate them into a reliable *process* would require far more time and effort, and at a far higher cost, than investment in *Backup**EDGE***. When you were finished, you wouldn't have all of the capabilities of *Backup**EDGE*** and your archives would not be as robust. For copying files between systems, archiving the occasional directory, etc. these are still excellent tools, and they are quite useful when a situation requires them.

Consider optical media, cloud storage, or network attached storage. While tar or cpio would be lost attempting to create and manage archives, support for this is fully integrated into *Backup**EDGE***, even at the command line level.

Network Attached Storage (NAS)? With its built-in ftp/ftps client, *Backup**EDGE*** can treat a NAS equipped with an FTP or FTPS server as a high performance tape library without any additional operating system tools. Similar built-in functionality exists to support cloud storage.

Backup Data Format

The part of *Backup**EDGE*** that performs *actions* within the data protection *process* is a powerful program called **/bin/edge**.

The data format incorporated into **/bin/edge** is based on the specifications of the Portable Archive Interchange (**pax**) standard as defined in IEEE 1003.1-2001 by The Open Group and the IEEE. In reality this format is actually the newest generation of the **tar** format. It provides a known, reliable data format definition with the provisions we needed to extend it into a full fledged data protection system. A few of the extensions we add are:

- The ability to archive and restore all known UNIX and Linux file types, including device files and sparse, or virtual files.
- Header checksum, **full file checksum** and bit-level verification schemes.
- Advanced data recovery from flawed media.
- Access Control List (ACL) support (Linux, OpenServer 6 and UnixWare 7).
- Flexible pathname inclusion and exclusion.
- Long pathname support. Pathnames may be up to 5,000 characters long, far longer than any other product, and more than any current operating system requires.

Microlite Corporation
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Aliquippa PA 15001-2228 USA
Tel: 724-375-6711

email:sales@microlite.com
web: www.microlite.com

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- Data encryption. The ability to secure either important files or entire archives from unauthorized tampering, with single file granularity and a choice of files to encrypt.
- Powerful internal data compression with single file granularity.

Taking shortcuts that bypass good system design can lead to disastrous results.

Somewhere over the years, maintainers of "free" versions of *tar* decided that piping the entire data stream through a compressor such as compress, gzip or bzip2 was a very good thing. In fact, it creates file archives with slightly higher overall compression than **/bin/edge**. It is also a great way to copy large volumes of files over a network link and expand and restore them at the other end. If something goes wrong, you can just do it over again.

Stream compression is disastrous, however, in permanent archives, and for two reasons...

- If even **one byte** of data is lost on a stream compressed archive, the decompress algorithm gets lost, and rest of the archive is virtually unrecoverable. It is simply not worth the risk for permanent archiving.
- *Backup**EDGE*** permanent archives are indexed by their file headers for fast access, which will be described later in this document. It can position to the start of and begin restoring any file or group of files from either optical media or a disk archive in under a second. On a tape device, it can use Quick File Access to get to the data to be restored in a matter of seconds. It is not unusual to restore a file from the end of a 50 gigabyte tape archive in less than 2 minutes, With stream compression, it would be necessary to read and decompress the entire archive on your way to restoring any file.

The **/bin/edge** program uses a tar-like command set with many extensions designed to allow it to integrate well with the rest of the *Backup**EDGE*** product.

Tape devices with internal, hardware based data compression algorithms do not generally require the use of software data compression, although the compression built into *Backup**EDGE*** is more modern and can provide higher compression rations. They provide all the redundancy needed to protect data, while providing the transparency needed for *Quick File Access*. The exception to this is encrypted files, which will be explained further below.

Data Encryption

*Backup**EDGE*** has a license option enabling public key data encryption. Users may choose to encrypt data by specifying filenames, directories or file extension types. Encryption uses the well documented AES encryption algorithm with 256 bit keys, which are further protected by RSA 2048 bit encryption. Encryption is performed at the file level, providing the following benefits...

- only data that needs to be protected is encrypted.
- overall performance stays high as only critical files are subject to CPU intensive encryption.
- full compatibility with our bit-level verify, file checksum verify, indexing, quick file access, error recovery and disaster recovery features is maintained.
- Each encrypted file is pre-compressed to ensure that no space is lost due to the inability of tape hardware compression implementations to compress encrypted data.

Microlite Corporation
2315 Mill Street
Aliquippa PA 15001-2228 USA
Tel: 724-375-6711

email:sales@microlite.com
web: www.microlite.com

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Optionally, a user may choose to encrypt an entire archive (except the file headers), although this is not recommended. Even when encrypting an entire archive, header data and single file granularity are preserved.

In contrast, encrypting entire archives by simply piping then through "crypt" or some similar utility is as dangerous as compressing them as described above. Single byte errors are likely to be catastrophic, and of course you must generally de-crypt the entire archive to restore a single file. Performance suffers dramatically. If keys are simply hashed passphrases, or otherwise generated by anything less than a cryptographically strong random number generator, they may be vulnerable to attack.

Users of encryption should be aware of the potential consequences of lost or stolen keys or pass phrases before utilizing this new technology. A separate whitepaper describes our encryption capabilities in more detail.

Enhanced Software Compression

*Backup**EDGE*** uses the industry-standard ZLIB compression library. ZLIB was chosen for having a great compression/time ratio. With our improved data format, no temporary space is required. ZLIB can compress almost any file type. Even highly compressed TIF files will get some benefit. Of course, files already compressed using GZIP or BZIP2 are excluded from compression by default. There are nine (9) selectable compression levels available to balance CPU speed against data transfer rates to achieve maximum backup throughput.

Software compression and encryption have a natural synergy. Encrypted files confuse the compression algorithms built into modern tape drives. When encountering files with non-pattern data, the compression algorithms either begin to compress negatively or temporarily disable themselves. Either way, net storage space and performance are impacted. By using software compression *before* encryption, it is possible to maximize available storage space while maintaining reasonable performance. Additionally, with pre-compressed files there is less data to encrypt.

Data Integrity Verification

Our products have used a combination of header checksumming and bit level verification for many years to guard against the potential for lost data. The 2.x and 3.x series add a third protection mechanism: *full file checksumming*.

Each file archived may include a checksum so that the archive may be read and tested at any time, even years from now, for full integrity. Additionally, each file is integrity checked during restore.

Installation and Setup

During *Backup**EDGE*** installation, all supported tape drives, optical drives, tape drives, as well as tape changers, libraries, and autoloaders, are detected automatically, and a *Resource* is created for each. A *Resource* is an abbreviation which references all of the capabilities of the device. Changer *Resources* may be associated with their attached tape drive *Resource* at this time. Tape device *Resources* can be measured for *Locate Threshold*, which optimizes our *Fast File Restore*, or *Quick File Access*, capabilities. It is not even necessary for the installer or user to know the UNIX or Linux device names. Installation

Microlite Corporation
2315 Mill Street
Aliquippa PA 15001-2228 USA
Tel: 724-375-6711

email:sales@microlite.com
web: www.microlite.com

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also prompts the user to create a *Resource* for backups to Network Attached Storage (NAS) devices, appliances or servers.

The *Installation Manager* can also scan the system for virtual files, also known as sparse files.

Hot plug support ensures that when plugging new devices into the system, current devices remain available even if their logical addresses change.

WORM support ensures that proper warnings are issues if the user attempts to overwrite WORM media.

Operating System Integration

After installation, a single program (**edgemenu**) provides access to all of the program's features. This program has both character and graphical user interfaces. It may be launched from a character console or terminal, or an X Windows terminal client in character mode, from an X Windows console equipped with Java™[1] in graphical mode, or as a Web Service from any computer with a Java equipped Web Browser

A *Backup**EDGE*** icon appears in the graphical root window, providing simple click access to **edgemenu**. Appropriate entries and icons, as needed, are also placed in the Utilities menus of KDE, **scoadmin** menus of OpenServer 5 and UnixWare, and in CDE desktop applications menus on appropriate systems.

Product Removal

*Backup**EDGE*** can be completely removed by typing a single command, or through *Custom (Software Manager)* on OpenServer 5 and 6.

User Interface

*Backup**EDGE*** has a state-of the-art user interface that can be rendered three different ways:

- in graphical mode as a *Web Service* from any web browser with a Java plug-in.
- in graphical mode on X11 consoles or clients equipped with Java.
- in character mode on system consoles, dumb terminals or xterm clients.

The user interface operates identically in all three modes (it is in fact a single compiled binary. It features pull-down menus, one-key, on-line context sensitive help, and fast "key jump" access to most features. The Java and Web Services modes are theme-based. Users / VARs / OEMs may adjust color and graphics for a customized look and feel. The character interface may be run in monochrome or color mode, and the palettes are user changeable with settings for over 160 different widgets.

Command line access is also available for all functions, including *Fast File Restore* / *Instant File Restore* and remote system access.

1. Java and Web Services interfaces require Sun Java. X11 console mode is available only on Linux.

Microlite Corporation
2315 Mill Street
Aliquippa PA 15001-2228 USA
Tel: 724-375-6711

email:sales@microlite.com
web: www.microlite.com

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Device Management

The *Resource* is the *Backup**EDGE*** software representation for your storage device. It knows all about how to **control** the device, **query** it, **write** to it, and **read** from it. It records the appropriate settings for the device to force data to be written in a consistent way.

By providing a central "point-of-control" for device configuration, *Backup**EDGE*** makes it easy to manage many hardware settings, even for devices that are used by many different backups, from many different machines. In the event the user wants to change (for example) the *Hardware Block Size* of his or her tape drive, it is necessary to change it only once.

As an example, an optical device can have up to eleven (11) different write strategies, depending on what type of media has been inserted. *Backup**EDGE*** can detect the capabilities and define write strategies automatically for these devices.

Job Scheduler

Flexible scheduling maximizes the use of storage devices while minimizing backup windows.

*Backup**EDGE*** has a powerful *Scheduler*, based on the concept of *Domains*, *Sequences*, *Scheduled Jobs*, *Retention Times* and *Quotas*.

- A *Domain* defines data that is to be protected by a backup, and how *Backup**EDGE*** should treat that data. It specifies which files or filesystems are to be treated specially, and what if any special actions are to be taken before and after the backup to prepare those files to be archived. You may specify as many *Domains* as you like to allow *Backup**EDGE*** to protect different subsets of your data separately. A *Domain* stands in contrast to "a list of files" as seen by *tar* or *cpio*, since it includes information about *how* the data in those files are to be accessed beyond simply the filename that is used to find that data. Examples of *Domains* might be "my accounting system files" or "my filePro database programs and files".
- A *Sequence* defines and tracks a unique group of *Master*, *Differential* and *Incremental Backups* for exactly one *Domain*. To maintain, for example, on-site and off-site backups that protect your entire system, a different *Sequence* would be used for each (although both *Sequences* would refer to the same *Domain*, since both protect the same data). This keeps the on-site and off-site backups separate, which is especially useful when performing *Differential* or *Incremental Backups*. When a scheduled backup is performed, it contributes a backup to exactly one *Sequence*, of the *Domain* referred to by that *Sequence*. In contrast, the *action* of copying data generally keeps no records at all!
- A *Scheduled Job* is a complete specification for a backup. It selects in which *Sequence* (and thus of what *Domain*) the backup will be, and defines which *Resource* will be used for it. It also specifies when the backup is to be done, what type of *Verify* pass (if any) is to be run, whether the backup should be indexed for *Fast File Restore*, and whether the backup should or can be made bootable for *Crash Recovery*. It records who is to be notified if the backup passes, and who else is to be notified if the backup fails. In the case of a *Resource* contained in an *Autochanger*, it optionally selects which tapes are to be loaded and on which days.
- Retention time is the **minimum** time before an archive can be overwritten. This can be used to prevent accidental erasure. It is

Microlite Corporation
2315 Mill Street
Aliquippa PA 15001-2228 USA
Tel: 724-375-6711

email:sales@microlite.com
web: www.microlite.com

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possible to set the retention time such that *Backup**EDGE*** will **never** overwrite the archive.

- A *Quota* is the amount of data a single *Backup**EDGE*** *Resource* can write to a Network Attached Storage Device, a disk device, or to Amazon S3 cloud storage. *Backup**EDGE*** will automatically reclaim space (erase archives whose retention time has expired) as needed. This is done in a "lazy" fashion. For instance, if you set a storage Resource Quota to 100GB, all archives will be retained until (a) a new archive needs more space and (b) an expired archive is available to be erased. Then and only then will an archive be erased. This always allows the maximum possible number of archives to be retained in case of a data disaster.

Any numbers of *Scheduled Jobs* can be created to back up *Domains* to *Resources* through *Sequences*. Each backup created can have its own **Retention Time**.

Options are available in the scheduler to create very versatile setups, such as performing backups on:

- Every Day of the Week.
- Last Day of the Month.
- Every Third Tuesday of the Month.
- First Day of the Year.

Each can have its own retention time. For instance, normal nightly backups may have a one week (or two week, three week, etc.) retention time while a backup performed on the last day of the month might be set to never expire and be automatically over-written. To re-use the media or storage space would require manual intervention.

** Enable the *Advanced Scheduler* and create a few different backup *Domains* for special data.

Disk-to-Anything-to-Anything Backups

After completing a backup/verify, the Scheduler can also automatically copy the backup to a different storage *Resource*. For instance, a backup could be sent to a removable hard disk or NAS device very quickly, then copied to a slower Resource such as a tape drive or to Amazon S3 cloud storage. During the copy, the archive is automatically segmented and compressed according to the Resource rules for the copy-to device. Additionally, the expiration time of the copied archive can be set differently than that of the primary storage *Resource*.

** *Schedule* a backup to a NAS, then copy it to tape or Blu-ray Disc automatically for off-site storage.

MySQL™ / MariaDB Hot Backups

*Backup**EDGE*** is capable of backing up MySQL / MariaDB (we'll just say MySQL here) databases without shutting them down, and without creating temporary files. During setup, you simply need to provide *Backup**EDGE*** with the Connection method, socket path, user name and password of the MySQL administrator. A special MySQL backup Domain is created, and this Domain may be added to any standard scheduled backup, or scheduled as a stand-alone backup.

*Backup**EDGE*** stores MySQL backups as a series of SQL commands. These commands, when executed, have the effect of restoring the data to the MySQL server. During restore, the date may be restored directly back in to the MySQL database or into table files for separate review, modification and/or later insertion back into the server.

Microlite Corporation
2315 Mill Street
Aliquippa PA 15001-2228 USA
Tel: 724-375-6711

email:sales@microlite.com
web: www.microlite.com

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** Setup MySQL Hot backups and *Schedule* a backup.

Advanced Notification

Full color email:
Critical messages sent to your pager or cell phone (or your VAR or system administrator):
No extra charge.

Any time a *Scheduled Job* is run, multiple users and printers may be *Notified*. For printers, any print command may be specified. For users, mail may be sent as plain text or MIME-encapsulated HTML with colorful pass / fail / warning icons. Additionally, mail messages can be formatted for numeric pagers, as well as alpha pagers, PDAs and cell phones.

There are two levels of *Notification*. Normal users get all messages, including successes, warnings and failures. Failures and warnings can also be sent to an additional group. In typical usage, a printed report and email are sent each day for logging purposes, while failures and warning are also sent to the system administrator or to the VAR or OEM responsible for the system.

** Change the *Message Format* type within a *Notifier* and perform a *Scheduled* backup to see the different output types.

Fast File Restore (Quick File Access)

*Backup**EDGE*** has the fastest and most versatile *Fast File Restore* capability in the industry. No one else is even close. It is capable of performing restores of multiple files or directories during a single pass through an archive and knows exactly when it is faster to move between files to be restored by using high speed positioning commands or by simply reading and discarding data.

No other product can restore multiple files or directories from tape as quickly as *Backup**EDGE***.

As each *Backup**EDGE*** backup is verified, an index database is created containing the file, type, link information, and exact beginning block of the header for each file on the archive. The database is kept on the hard drive until the tape is overwritten. After a default number of days, the file is highly compressed, and quickly un-compressed if any of the *Fast File Restore* programs attempt to use it.

For the dial-in or network administrator, command-line based *Fast File Restore* from tape or *Instant File Restore* from optical media are at your fingertips.

There are two *Fast File Restore* methods available; directly from the GUI / character interface (**edgemenu**) or from the command line interface (CLI) program (**edge.restore**). Each is capable of restoring not only the file selected, but also the source file in the case of linked or symbolically linked files.

Some really olde tape drives cannot perform *Fast File Restore*. *Backup**EDGE*** can test for this, and also determine the optimal positioning capabilities for device / operating system combinations that pass the test.

** Perform a *Master Backup*. Select three files or directories, one from the beginning, one from the middle, and one from the end of the archive, and restore them in a single pass. Compare the total time it takes against other products. (Hint: you can judge the relative location of a file on a *Master Backup* by scanning through the file **`/usr/lib/edge/lists/simple_job/backup_system_master.txt`**. The log is sequential.)

Instant File Restore

When performing optical, NAS, Cloud, or disk/flash backups, *Backup**EDGE*** can instantly position to any spot on the archive, or open an archive at exactly the right block to restore files or directories. In

Microlite Corporation
2315 Mill Street
Aliquippa PA 15001-2228 USA
Tel: 724-375-6711

email:sales@microlite.com
web: www.microlite.com

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actual use, its operation is the same as *Fast File Restore*, but positioning is virtually instantaneous.

Yes, you read that correctly. *Backup**EDGE*** can access any file on a NAS or cloud backup and begin a restore within seconds.

** Try a backup and *Instant File Restore* yourself.

Device Control

*Backup**EDGE*** has built-in low level tools that allow complete control of optical drives, tape drives, autochangers and libraries.

The **optical tools** allow us to detect the capabilities of the device, and type of media that has been inserted. We can then determine whether the media is writable, whether it needs to be initialized, blanked or formatted before use, what volume size to use, and what type of write command must be issued.

The **tape drive tools** allow us to detect media presence, media write protect status, media density and other basic tape drive information, and to change block size, compression, and partition information, among other things. Uses for these will be explained later in this document.

The **changer / library tools** allow us to query tape changers for number of elements, element status, and barcode labels, and to move tape cartridges between elements randomly. The cartridge may be specified by element number or Private Volume Tag (barcode id).

There are three primary advantages to these low level device layers:

- The *Backup**EDGE*** user interface programs use the tools to take total control of a device, and ensure its availability, media status, and mode before beginning a backup. Many programs don't even bother to check to see if there is media in the drive before starting a backup, or whether the media is write enabled. *Backup**EDGE*** can detect and exit gracefully from these types of problems. It can also detect whether optical media needs to be formatted before use (DVD+RW) or erased before re-use (CD-RW) and performs the required operation automatically.
- The tools each have their own user API, meaning that programmers may use them to write their own program and scripts with complete device knowledge. They can each report results in plain english, or export their queries as environment variables for use by other programs.
- The tools are exactly the same on all operating systems that run *Backup**EDGE***. This means that a program written to control a tape drive or changer under OpenServer will work exactly the same on Linux, UnixWare, or any other platform for which *Backup**EDGE*** available. They also tend to have far more features and higher performance than most public or generic tools.

** Evaluators should try the following commands on tape drives to test the basic capabilities of the APIs. These assume the default names for the first tape drive and changer. Raw device names may also be used.

Simple drive Inquiry - Human Readable **`/usr/lib/edge/bin/edge.tape -i tape0`**
Simple drive Inquiry - Script Readable **`/usr/lib/edge/bin/edge.tape -terse -i tape0`**

Microlite Corporation
2315 Mill Street
Aliquippa PA 15001-2228 USA
Tel: 724-375-6711

email:sales@microlite.com
web: www.microlite.com

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Extended drive Inquiry - Human Readable **`/usr/lib/edge/bin/edge.tape -i tape0`**
Extended drive Inquiry - Script Readable **`/usr/lib/edge/bin/edge.tape -terse -i tape0`**
TapeAlert Inquiry- Human Readable **`/usr/lib/edge/bin/edge.tape -V tape0`**
TapeAlert Inquiry - Script Readable **`/usr/lib/edge/bin/edge.tape -terse -V tape0`**
Changer Inquiry - Human Readable **`/usr/lib/edge/bin/edge.changer show changer0`**
Changer Inquiry - Script Readable **`/usr/lib/edge/bin/edge.changer -terse show changer0`**

Network Attached Storage

*Backup**EDGE*** has an FTP/FTPS client which is built directly into the backup engine and treated as a standard storage "Resource". It is also completely NFS and SMB/CIFS aware. This means that virtually any server or storage appliance, running **any** operating system, can be used as a backup device, as long as it is running an FTP, NFS or SMB/CIFS server and available via a network connection. It is now possible to:

- Use any Network Attached Storage (NAS) device to reduce backup windows and consolidate archives.
- Create your own inexpensive storage server.
- Have two servers backup to each other for redundancy, over your intranet or the Internet.
- Create a star or ring topology, allowing each server to store archives to another server.
- Consolidate all your server backups by sending them to a data center, eliminating the expense of local storage devices.
- Increase the frequency of data protection. Perform multiple differential/incremental backups per day.

Unique Features

- NAS backups are segmented automatically, and are not limited by either "ulimit" or file size limitations on either the local system or the backup server. The high performance compression built into *Backup**EDGE*** reduces network bandwidth and storage space requirements. All of the other *Transparent Media* features apply.
- NAS devices are treated similarly to autochangers, allowing simple backup rotations and retirement policies. Whenever a restore is requested from a NAS, all current archives are listed and the user may choose the archive to be restored.
- Non-scheduled backups can be given a "Slot Name", or unique storage identification.
- NAS management is included. NAS backups can be viewed and removed at any time. "Volume Size" for a NAS resource is actually a storage quota, or maximum storage allotment for all archives created by the Resource.

Microlite Corporation
2315 Mill Street
Aliquippa PA 15001-2228 USA
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email:sales@microlite.com
web: www.microlite.com

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- With FTPS, the transport layer itself can be encrypted, protecting your data during transit over the intranet or internet.
- A re-start option may be used, allowing *Backup**EDGE*** to automatically recover from lost connections when using FTP or FTPS.

*Backup**EDGE*** also has complete, transparent support for performing network backups from one server to the storage device on another, as long as both are equipped with *Backup**EDGE***. Our protocol allows changer support, checking for inserted media and write protection, block size, compression partition checking and setting just as if the device were attached to a local system. We can even do *Fast File Restore* or *Instant File Restore* over the network! In short, the local copy of *Backup**EDGE*** treats the remote device just as if it were attached to the local system.

Cloud / Internet Backups

Many providers offer cloud object storage services compatible with the S3 Object Storage protocol, originally designed by Amazon Web Services and known as **Amazon S3**, or simply **S3**. It uses an object-based storage interface and the HTTPS transport mechanism.

Think of **S3** as a storage server with virtually unlimited storage space and bandwidth, and high availability. To read more about the benefits of these services, browse to *http://aws.amazon.com/s3*.

*Backup**EDGE*** treats any compatible Object Storage site as a standard storage *Resource*, with many similarities to *FTP Backups* (Network Attached Storage). It is a fully functional *Resource*, capable of:

- Full or partial system backups.
- Checksum and full bit level archive verification
- Instant File Restore™
- Bare metal disaster recovery with *Recover**EDGE***.

As with any other *Backup**EDGE*** Resource, servers can be set up to perform complete Master, Differential and Incremental system backups. Individual backup subsets (we call them backup Domains) may be created as a supplement to locally hosted backups.

Storage pricing is very reasonable. Please see the pricing pages of the individual storage vendors for the latest information.

The **S3** Object Storage API has been adopted by many other storage providers, including **Google Cloud Storage**, **Wasabi**, **Backblaze B2**, and **Digital Ocean Spaces**. Additionally, local Object Storage is also available on many NAS devices and with **MIN**IO application software. See the Microlite S3 Compatibility Page. You may also check with your favorite cloud storage provider to see if they offer an **S3-compatible** Object Storage API.

D2D - Directory Backups

Backups may be sent to flash media, removable hard drives, and related devices such as the RDX, RD1000 GoVault removable disk cartridge systems (operating system permitting). *Backup**EDGE*** will manage mounting and unmounting the media as required. Removable media backups may be used for single-media backup and disaster recovery. Flash cards / removable HDs can be made bootable under Linux 2.6 and later. On other platforms you must use Blu-ray Disc / DVD / CD (etc.) boot media with them for bare metal disaster recovery.

Microlite Corporation
2315 Mill Street
Aliquippa PA 15001-2228 USA
Tel: 724-375-6711

email:sales@microlite.com
web: www.microlite.com

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Backups may also be sent over NFS or SMB/CIFS mounts in this fashion. However, disaster recovery does not support these transports on all platforms, so FTP or FTPS is the recommended way to perform remote backups.

Backups may additionally be sent to a directory on an existing filesystem. *Backup**EDGE*** will not attempt to mount or unmount any devices for this case. Again, these backups may be quite useful for targeted snapshots, but are not suitable for disaster recovery, as they're stored on local storage and may be erased by the disaster recovery process!

All of the other *Transparent Media* features apply.

Command Line Interface (CLI)

We recognize that despite the power and flexibility of the **edgemenu** and Scheduler interfaces, people have custom uses that require archives to be created from the **/bin/edge** command line.

*Backup**EDGE*** has the exclusive ability to create archives to Resources in addition to files. For example:

/bin/edge cvf optical0 /bin
would automatically create an archive on whatever appropriate CD, DVD or Blu-ray Disc media was inserted into an optical drive. The right media strategy, preparation (blank, format, etc.), compression and volume size would be selected automatically by the Resource settings.

/bin/edge cvf url0 /bin
would automatically create an ftp/ftps backup, negotiating link type, passwords, compression, etc. from Resource settings.

Additional command flags are available for fine control of compression, slot name, etc. No other product has such a capability.

TapeAlert™

Modern tape drives have extensive diagnostics. It is critical that system administrators have easy access to the information they provide.

Today's tape storage devices very smart They store vast amounts of information about what they've been doing recently, and most are fully capable of diagnosing themselves. They are capable of informing users when they need to be cleaned, or repaired, are currently working with bad media, or are simply installed in a bad environment.

Reporting on problems is done through *TapeAlert*, a standard pioneered by Hewlett Packard and now used almost universally by the storage industry.

The *Backup**EDGE*** device layer includes full support for pulling queued *TapeAlert* messages out of the drive, either on demand or during nightly unattended backups. These hardware message are an excellent diagnostics tool, and save countless hours diagnosing or "guessing" where problems may lie, as the tape drive itself may know the answer. We've had two occasions in our office where tape drives have warned us that they were about to fail, before a single byte of data was lost.

TapeAlert reporting alone is generally sufficient cause to justify the investment in *Backup**EDGE***.

Different vendors implement different reporting subsets of the *TapeAlert* standard, but *TapeAlert* reporting alone is generally sufficient cause to justify the investment in *Backup**EDGE***.

Here is an example of an actual *TapeAlert* message received during a backup on a Microlite server:

```
Found TapeAlert (tm) Message After Backup
TapeAlert(tm) Message From mlite:tape0:
```

Microlite Corporation
2315 Mill Street
Aliquippa PA 15001-2228 USA
Tel: 724-375-6711

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web: www.microlite.com

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```
The operation has stopped because an error has occurred
while reading or
writing data which the drive cannot correct.
Your data is at risk:
     1. Copy any data you require from this tape.
     2. Do not use this tape again.
     3. Restart the operation with a different tape.
The tape is from a faulty batch or the tape drive is faulty:
     1. Use a good tape to test the drive.
    2. If the problem persists, call the tape drive supplier
helpline.
```

The tape in use was discarded, obviously.

Update Manager

The automatic update facility ensures that the most recent release of *Backup**EDGE*** is always available.

The *Update Manager* allows *Backup**EDGE*** to check the Microlite Corporation update site for later releases. The check can be run interactively through **edgemenu**, or performed by the *Scheduler* on a periodic basis. If an update is found during a scheduled check which is allowed by the current product activation code, the user is notified automatically. In addition, the update can be automatically downloaded. Of course, it won't be installed unless the user chooses to do so interactively.

You will also be notified if a new release becomes available that requires a **Support and Maintenance Subscription** renewal.

Non-Profit / Charity Licensing

*Backup**EDGE*** is available under special pricing for non-commercial use only. It has 100% of the features of the commercial product, but is available only to qualified US non-profit organizations and Canadian Registered Charities.

Installation Media and Files

*Backup**EDGE*** is istributed electronically, via individual, operating system specific executables or via a downloadable CDROM ISO image. Installations from either format function identically. That is...

- When first installed, *Backup**EDGE*** will run with all features[1] enabled for 60 days. During this time, it must be registered and activated with a purchased license or it will stop functioning.
- It may be installed directly over a current distribution from the same series as an update.

So the same demo is actually the full product, a demo, or an update depending on whether it is properly licensed.

From our Web/FTP Site

Our **ftp** download site (**`ftp://ftp.microlite.com`**) features multiple types of distribution formats...

- The entire distribution CD-ROM ISO image.
- Standard *tar* format installation archives. Simply extract from the root (**/**) directory and run **`/tmp/init.edge`**.

1. The P2V feature in Linux products is not available under the demo license.

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Aliquippa PA 15001-2228 USA
Tel: 724-375-6711

email:sales@microlite.com
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- ELF Executable. Simply download the file and execute it, and the installation begins automatically. This is the recommended and most often used format.

Full documentation may also be downloaded.

** Use the CD-ROM or ELF executable installer. Allow *Backup**EDGE*** to detect your storage devices, and create and configure *Resources* for them.

Bare Metal Disaster Recovery

No other product offers the range of disaster recovery media and options that are built into *Backup**EDGE***.

This is an area where *Backup**EDGE*** outshines all the competition, and does so under Linux, OpenServer 6, OpenServer 5 and UnixWare 7.

Disaster Recovery Media Creation

*Recover**EDGE*** offers the most disaster recovery media types available:

- Media-free network booting via PXE (Linux)
- Bootable USB / SATA flash drives, disk drives and cartridge drives under Linux 2.6.x and later kernel releases (SharpDrives™)
- Bootable Optical Media
- Bootable OBDR™ Nightly Backup Tapes (deprecated)

For virtual servers, blade servers and other legacy-free systems, the Linux version of *Recover**EDGE*** can create boot images that can be placed on a TFTP server, allowing the system to be booted into disaster recovery mode from the network card, without traditional boot media. This is capability, along with Network or Cloud backups, provides the ability to create inexpensive, highly secure systems by eliminating the need to have any floppies, optical drives, or even tape drives installed.

Systems with advanced hardware may create additional types of boot media.

- Bootable optical disaster recovery media may be made on an optical drive attached to the local system or may be automatically burned on an optical drive attached to any other UNIX or Linux system on the network. There is even a procedure for creating a ISO image file, then transferring the image to a Windows or PC or other server to make the media. The bootable optical media is used along with your backup tapes.

  Optical media may also be used for system backups. Further, the backups may be made bootable, providing a complete solution for both disaster recovery and system replication.
- Linux 2.6.x and later kernels can make use of USB hard drives, flash drives and disk cartridges, as well as SATA cartridge drives. Each can be made bootable + contain as many system backups as they can handle, size-wise. We call all of these devices "SharpDrives"[1].
- Bootable nightly backup tapes take advantage of Hewlett Packard OBDR technology. Each attended or unattended backup can be made bootable. No optical media is required. *OBDR* requires supported HP Ultrium (LTO) or DDS drives or desktop changers and a server BIOS that supports *OBDR*.

1. SharpDrives in Llnux configured with FDISK can be made bootable in Linux. GPT-formatted SharpDrives in Linux configured with GPT cannot be made bootable. In this instance, standard optical media, ISO images, or PXE images may be used.

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Hardware Platform Support

Both modern and legacy platforms are supported.

- BIOS or UEFI Support (Linux).
- FDISK and GPT Support (Linux).
- BIOS and FDISK Support (all other platforms).

Modem Disaster Recovery

After the boot media have been loaded, a remote administrator may log in via modem and take care of a crash recovery session. This will be explained in more detail in **Remote Administration** below.

Network Disaster Recovery

*Recover**EDGE*** has complete networking capabilities. Assuming that the target system has networking enabled, the boot media will contain all the tools to start a network stack. When the media is booted, networking can be initialized, which serves three purposes:

- Data can be restored from NAS devices or Cloud Services. Before restore, a list of available backups will be displayed for the user to choose from.
- Data can be restored from remote *Backup**EDGE*** resources.
- Remote administrators can telnet in and take over a disaster recovery session.

Remote Administration

*Recover**EDGE*** has excellent remote administration capabilities. Network and modem users are treated virtually identically. When a modem or a telnet connection is made, *Recover**EDGE*** attaches the remote port to the system console in a manner similar to "DoubleVision" in UNIX or "Remote Control" programs in Windows. The screens are mirrored, and the local system user can watch exactly what the remote user is doing.

The remote user can use the menus to go through a system configuration and restore, and has full access to the UNIX shell if desired. There is unlimited disconnect/reconnect capability. Whenever the remote user disconnects, control is simply returned to the system console with no process receiving a hang-up. If the remote user configures the drives, then begins a restore, he or she can disconnect immediately and re-attach later, saving telephone or network charges. The local user can watch files being restored and then shut down afterwards, or the remote administrator can get back in at any time and have his/her screen updated with what's happening on the system.

Telnet administration goes a step further. An inbound telnet port may be specified in order to get through security firewalls that may block the default telnet port. In addition, a remote administrator may start a second telnet session which displays status and table files, giving them the equivalent on the remote system of one of the multi-screens used by *Recover**EDGE*** on the system console.

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OneTouch Restore

*Recover**EDGE*** is capable of automatically re-configuring filesystems and partitions on a new hard drive to appear exactly as they did on the drive it replaces. If the drive is not the same size, partitions can be scaled automatically.

Of course, complete manual control of the hard drive is also possible. Under Linux, OpenServer 6 and UnixWare 7, special interfaces replace the hard-to-use native tools and allow easy menu driven configuration. It is even possible to move filesystems from one hard drive to another and *Recover**EDGE*** will take care of updating the appropriate system files.

Linux P2V Restore

*Recover**EDGE*** is capable of automatically re-configuring host bus adapters drivers and device mappings to transition from any physical host adapter to a VMware-compatible (03.00.07 or later) or Hyper-V (03.01.03 build 5 or later) host bus adapter during recovery. This facilitates Pv2 conversion on compatible Linux distributions.

Compatibility

Extensive engineering and testing is done to ensure that *Recover**EDGE*** will work when you really need it. For example:

Under Linux, *Recover**EDGE*** is tested with all major distributions, including Red Hat Enterprise Linux, Novell/SUSE and Ubuntu. It understands the peculiarities of the installation and boot control systems used by each. *Recover**EDGE*** does not force a "one size fits all" solution onto every system; it performs many sanity and common error checks. For example, if LILO is configured to install itself onto a partition rather than onto the Master Boot Record, *Recover**EDGE*** will offer to restore the old MBR during recovery in addition to reinstalling LILO. Without this step, after "recovering" such a system onto a *blank* hard drive, it would not boot. It knows when GRUB has been used instead of LILO as the boot manager and takes all the appropriate steps. It understands how to rebuild ext2, ext3, ext4, Reisfer, JFS and XFS filesystems. It also understands how to re-create LVM2 (Logical Volume Manager 2) partitions under Linux 2.6.x and later kernel releases, as well as MD RAID partitions under Red Hat Enterprise Linux 7.x and later, Oracle Linux Server 7.x and later, and CentOS 7.x (requires 03.04.01 build 1 or later). Beginning with 03.01.04, it recognizes GPT partitions in addition to FDISK partitions. Beginning with 03.04.00, it recognizes NVMe devices and **/dev/vdX** disk device nodes.

Under OpenServer 5, *Recover**EDGE*** has BTLD (Boot Time Loadable Device Driver) support. This will become critical as older systems begin to fail, and new, compatible host adapters are no longer available.

Under Linux, UnixWare 7, OpenServer 6, and OpenServer 5, *Recover**EDGE*** will use your existing device drivers, rather than pre-configured or generic ones. While most OpenServer 5 disaster recovery systems do this, the common approach to Linux and UnixWare recovery is to provide a "stock" kernel for the disaster recovery media. Unfortunately, any patches applied to the real kernel will not be present during disaster recovery with the "stock" kernel. This can be disastrous, and very difficult to detect until it is too late.

** *Recover**EDGE*** can create *usable* media in situations where other products will fail. Make disaster recovery media, boot from it, and try

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things like reading a local or remote backup tape. Telnet or modem in from another system and take control.

Technical Support

Microlite live technical support is available from 9:30am to 5:00pm US Eastern time, Monday through Friday, to users under valid *Support and Maintenance Subscriptions*. We also offer free non-priority email support for products for up to 5 years after their *Support and Maintenance Subscription* expires. Email is also checked during non-business hours and on weekends.

Summary

*Backup**EDGE*** has:

- Organized, *process* based data protection.
- Superb data format with advanced verification, error recovery, encryption and compression engineered in, not bolted on.
- Excellent installation, device detection, and operating system and desktop integration.
- Powerful device support, control and diagnostics.
- Easy, fast and powerful multi-protocol NAS support.
- S3 API cloud storage support.
- Advanced user interface technology.
- Versatile scheduling.
- Update management.
- Multi-format notification with escalation capability.
- Reliable *Fast File Restore* and *Instant File Restore* capabilities.
- Transparent remote backup support.
- The best technology and most capabilities in our disaster recovery components.
- Cost effective commercial and non-profit license pricing.

Thank you for taking the time to read a somewhat long document. We do believe that a full evaluation of our products will show that they are the best available, and with the best backing available, providing best-of-breed features, benefits and support not found in any other product.

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Aliquippa PA 15001-2228 USA
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