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AIX Update

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Trevor Eddolls

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Recovery of an inadvertently removed filesystem

If you have ever removed a filesystem by accident, you probably wanted to recover from the situation without needing to restore from a back-up. There is indeed a way to do this, but you will need some information taken prior to the accident.

As you know, the logical partitions of a logical volume are mapped to physical partitions on one or more hdisks; and the information for this mapping is essential to recreate the logical volume and its associated filesystem in the case of an accident.

Please be aware that doing an **rmfs –r <filesystemname>** will remove the filesystem itself, the underlying logical volume, and the associated mountpoint.

I believe that you, being a good system administrator, will have already set up some procedures to back up critical information on your managed systems; so you only have to enhance these procedures to store the logical volume mapping in a safe place – if you have not already done so.

The following will describe, in a step-by-step way, a kind of training scenario so that you can become familiar with the tasks involved.

SETTING UP THE TEST SCENARIO

First, we will create a logical volume and an associated filesystem for test purposes with only one logical partition. Let us assume the existence of a volume group named lvtestvg already created on hdisk2:

```
mklv -y lvtest lvtestvg 1 hdisk2
crfs -v jfs -d lvtest -m /to_be_removed -A yes
mount /to_be_removed
```

Now we will create a subdirectory, and put into it a file containing some data:

```
mkdir –p /to_be_removed/subdir1
ps –ef > /to_be_removed/subdir1/data1
```

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The next step shows how to collect the mapping information of all logical volumes within all active volume groups of a system; please be aware that we are only interested in getting the information for the first logical volume copy even if the removed logical volume has been mirrored. In our scenario we use an unmirrored logical volume but the procedures described will also work well with a mirrored one:

```
for VG in $(lsvg –o)
do
for LV in $(lsvg -l ${VG} | grep -Ev „${VG}|${LV}" |awk ,{print $1}')
do
lslv -m ${LV} | grep ^[Ø-9] | awk ,{print $3 „:" $2}' > map_${LV}
done
done
```

You now have a mapping file named *map_<logical volume name>* for each logical volume within all your active volume groups.

Now we will remove the filesystem to complete our test scenario:

```
umount /to_be_removed
rmfs –r /to_be_removed
```

RECREATING THE LOST DATA

The next command will work only if the physical partition of our removed logical volume is not associated with another logical volume which, for example, has been created just after deleting our test logical volume. So if you inadvertently removed a filesystem, make sure that nobody else is working on your system and creating filesystems. Be aware that you must specify the number of logical partitions that the logical volume consists of:

```
mklv -y lvtest -m map_lvtest lvtestvg 1
```

Now you have to manually edit the */etc/filesystems* and create the lost entry of your filesystem. Do not create the filesystem by using the **crfs** command or you will be sorry:

```
/to_be_removed:
        dev             = /dev/lvtest
        vfs             = jfs
```


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```
        log             = /dev/loglv00
        mount           = true
        check           = false
        options         = rw
        account         = false
```

The */dev* entry represents your logical volume name and the log-device can be found by looking at your volume group.

Do a filesystem check just to verify that almost everything is OK:

```
fsck –y /to_be_removed
```

When you have a look at the Logical Volume Control Block (LVCB), you will see that there is just a little work to do:

```
getlvcb -AT lvtest
```

The output will look similar to this (I truncated the unimportant lines):

```
AIX LVCB
         intrapolicy = m
         copies = 1
         interpolicy = x
         lvid = 0000715716b08348.10
         lvname = lvtest
         label = None
         .....
```

and as you can see here, the label – which is the mountpoint of our filesystem – is still missing. Just do the following:

```
chfs -a log=/dev/loglv00 /to_be_removed
mkdir /to_be_removed
mount /to_be_removed.
```

For the paranoid among us, do a **getlvcb -AT lvtest** again to see that everything is now OK.

To finalize the whole procedure, do not forget to mirror your logical volume if it was a mirrored one or if you would like to have it mirrored now.

That's it.

Marcus Zitranski
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AIX system time synchronization using NTP protocol

Time value synchronization is essential for the operation of many computer systems. Services such as DNS, Kerberos, cron, and advanced scheduler systems such as IBM's Load Leveler depend on the synchronization of the clocks on the servers involved.

The Network Time Protocol (NTP) was designed to automate time synchronization across a network. It has replaced the previously available and now obsolete TIMED protocol.

NTP OPERATION OVERVIEW

NTP works as a hierarchical client/server network consisting of the following types of node:

- A client node queries the reference time from one or more servers.
- A server node makes its time available as the reference time for other clients.
- A peer node compares its system time with other peers until all the peers finally agree about the 'true' time to synchronize on.
- A broadcast/multicast server – an NTP server can also operate in a broadcast or multicast mode. Both work similarly – broadcast servers send periodic time updates to a broadcast address, while multicast servers send periodic updates to a multicast address. Using broadcast packets can greatly reduce the NTP traffic on a network, especially for a network with many NTP clients.
- A broadcast/multicast client – an NTP broadcast or multicast client listens for NTP packets on a broadcast or multicast address. When the first packet is received, it attempts to

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quantify the delay to the server in order to better quantify the correct time from later broadcasts. This is accomplished by a series of brief interchanges where the client and server act as a regular (non-broadcast) NTP client and server. Once these interchanges occur, the client has an idea of the network delay and thereafter can estimate the time based only on broadcast packets. If this interchange is not desirable, it can be disabled using NTP's access control features. The **-r** option can be used when **xntpd** is started to hardwire a delay if the interchange fails because of access control issues or other problems.

The hierarchical levels of the time synchronization structure are called stratum levels. A smaller stratum number means a higher level in the hierarchy structure. On top of the hierarchy there is the daemon, which has the most accurate time and therefore the smallest stratum number.

By default, a daemon's stratum level is always one level below the level of its reference time source. The top-level daemon often uses an external device as a reference time source. Such devices have a stratum number of 0, so a daemon that uses that precision time device as a reference time source will be a stratum 1 time server, which has the highest priority level in the NTP hierarchy. In large networks, it is a good practice to install one or more stratum 1 time servers, which make a reference time available to several server computers in each department. Thus the servers in the departments become stratum 2 time servers, which can be used as reference time sources for workstations and other network devices of the department.

In fact there are several ways to obtain authoritative time:

- To connect the system to an external autonomous atomic clock.
- To dial your national institute of standards using a modem.
- To connect your system to a GPS-based (Global Positioning System) device, which receives time values as well as positioning information from satellites.

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- It is possible to obtain authoritative time values from external stratum 1 and 2 NTP Internet servers. This is the most common source for Internet-connected organizations that don't require more extreme precision. Note that some servers require advance permission before time synchronization can be implemented.

Each NTP daemon can be configured to use several independent reference time sources. It synchronizes to the reference time source with the highest stratum and lowest jitter and dispersion. If that reference time source becomes unavailable then the daemon automatically switches to the best of the remaining time sources, which may also result in a change to the daemon's stratum value.

When an NTP daemon is working on a client, periodic adjustments to a system clock are made based on the authoritative time data that is received from the NTP servers. If the current time on the client system differs by more than 128 milliseconds, the NTP daemon resets the local system clock. If the difference is smaller, the NTP adjusts the local clock gradually in small steps. Over time the NTP daemon records and analyses successive time errors and continues to correct the time automatically based on this data, even when the time server systems are unreachable.

It is customary to set up the NTP using multiple sources of authoritative time. This precaution is taken in order to protect the NTP server from single points of failure and unreliability of a single time server (resulting from hardware failure, malicious tampering, etc). Similarly NTP clients are set with at least three sources of time information.

BASIC NTP CONFIGURATION ON AIX

The first step in setting up any NTP-based network is thorough planning. Among the things to consider are:

- Number and origin of authoritative time servers.
- Number and location of NTP servers within the organization.

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- Distribution of time servers between the NTP clients in a balanced and protective way.

In AIX, the NTP support is installed by default as part of the bos.tcpip.client fileset.

The NTP system configuration resides in file */etc/ntp.conf*.

To define an NTP server that uses well-known Internet-accessible servers, use the following:

```
# Direct the NTP to NOT use broadcast based syncronization
broadcastclient no
# Define three Internet-accessible servers by IP address
server 128.46.136.95 # US IN PERDUE
server 14Ø.239.1Ø.5   # US MA CONCORD
server 128.118.25.3 # US PA PENN ST
# Next two lines define local computer system clock as very low priority
# (last chance) time source
server 127.127.1.Ø
fudge 127.127.1.Ø stratum 12
# Define the file to save the local clock drift from the reference time
# to be used after the system restart
driftfile /etc/ntp.drift
```

A typical local client can have the following */etc/ntp.conf* contents:

```
# Direct the NTP to NOT use broadcast-based synchronization
broadcastclient no
# Define three local NTP servers by host name
server ntphost1
server ntphost2
server ntphost3
# Define the file to save the local clock drift from the reference time
# to be used after the system restart
driftfile /etc/ntp.drift
```

There are many more options that can be set up using the configuration file. Please refer to the NTP manual pages for details.

The next step is to uncomment the following line in the file */etc/rc.tcpip*:

```
start /usrs/bin/xntpd  "$src_running"
```

This will enable the automatic restart of the NTP daemon following a reboot of the server.

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The next step is to execute the **ntpdate** utility with the name of the existing NTP server in order to perform initial synchronization of the local system clock with the reference server:

```
ntpdate  -d ntphost1  ntphost2 ntphost3
```

Wait for an acknowledgement that a good connection has been established.

Perform the actual time synchronization:

```
ntpdate  -d ntphost1  ntphost2 ntphost3
```

Finally you can start the NTP daemon from the command line using:

```
startsrc –s xntpd
```

MONITORING NTP STATUS

The **/usr/sbin/ntpq** utility enables the state of the NTP daemon on a local or remote computer to be queried. Using **ntpq**, an administrator can check the configuration of a remote host. If such queries are allowed on a host, this can be a useful way of choosing hosts to synchronize with, because information such as their peers and reference clock types can be determined. Since **ntpq** uses UDP packets, hosts may be falsely unreachable on congested networks.

ntpq can be run in an interactive mode or in batch mode. In batch mode, **ntpq** executes a command and returns to the command prompt. The parameter **-p** (‘peers’) lets **ntpq** print the status of an NTP daemon. Enter:

```
ntpq -p
```

to display the status of the daemon on the local machine, or:

```
ntpq -p ntphost
```

to display the status of the daemon on the remote host ntp_server. The command should print a table with one status line for each reference time source that has been configured for the NTP daemon on the specified host:

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```
   ntpq -p
 remote       refid      st t when poll reach   delay   offset    disp
==============================================================================
*ntphost1     LOCAL(1)    4 u  536 1024  377     0.43    0.197    0.17
+ntphost2     ntphost1    5 u  679 1024  377     0.92   -3.240    0.64
+ntphost3     ntphost1    5 u  593 1024  377     2.93    1.100    0.12
```

The table above shows the output for an NTP daemon, which has three reference time sources: hosts running NTP protocol and named ntphost1, ntphost2, and ntphost3.

If the first character of a line is not blank then it contains a qualifier for the corresponding reference time source. Immediately after the daemon has been started, all qualifiers are blank. The NTP daemon needs several polling cycles to check the available time sources and declare one of them as the reference it synchronizes with.

An asterisk * in the first column marks the reference time source which is currently preferred by the NTP daemon, the + character marks high-quality candidates for the reference time that could be used if the currently selected reference time source should become unavailable.

The column *remote* displays the IP address or the host name of the reference time source, where LOCAL refers to the local clock. The *refid* shows the type of the reference clock, where LOCAL or LCL refers to the local clock, .DCFa refers to a standard DCF77 time source, and .PPS indicates that the reference clock is disciplined by a hardware pulse-per-second signal. Other identifiers are possible, depending on the type of the reference clock.

The column *st* reflects the stratum number of the reference time source. In the example above, the remote time server ntphost1 has stratum 4, which is the best you can find on this network, and the other servers have stratum 5.

Every time a *when* count reaches the poll number in the same line, the NTP daemon queries the time from the corresponding time source and resets the *when* count to 0. The query results of

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each polling cycle are filtered and used as a measure for the clock's quality and reachability.

The column *reach* shows whether a reference time source could be reached at the last polling intervals, ie data could be read from the reference time source, and the reference time source was synchronized. The value must be interpreted as an 8-bit shift register whose contents are displayed as octal values. If the NTP daemon has just started, the value is 0. Each time a query was successful a '1' is shifted in from the right, so after the daemon has been started the sequence of *reach* numbers 0, 1, 3, 7, 17, 37, 77, 177, 377. The maximum value 377 means that the eight last queries were completed successfully. The NTP daemon must have reached a reference time source several times (reach not 0) before it selects a preferred time source and puts an asterisk in the first column.

The columns *delay*, *offset*, and *disp* show some timing values that are derived from the query results. All values are in milliseconds. The *delay* value is derived from the roundtrip time of the queries. The offset value shows the difference between the reference time and the system clock. The *disp* value indicates the magnitude of dispersion between several time queries.

The **/usr/sbin/xntpdc** program also allows the state of a local or remote NTP daemon to be queried; however, **xntpdc** can also make runtime configuration requests to a remote machine. This allows the configuration to be changed on-the-fly. In order to make runtime configuration changes, an authentication key is needed. This requires the creation of an NTP keys file, which is described in the **xntpd** man page. Like **ntpq**, **xntpdc** uses UDP packets.

The **/usr/sbin/ntptrace** is an informational command that traces the source of a given client's time. The information found by **ntptrace** can be determined by successive runs of **ntpq** on each client's preferred server. However, **ntptrace** provides an easy and convenient way of learning this information. This can be a useful tool for debugging.

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This program sends an NTP packet to the specified server. If possible, the server will respond with an NTP packet. The host **ntptrace** was run on will use this information to determine the stratum, offset, and synchronization distance, as well as the next server in the hierarchy. Since **ntptrace** now knows the next server in the hierarchy, it sends that server an NTP packet. This continues up the hierarchy. If the next server is not reachable, a time-out results.

However, because of the above implementation, there are some problems with **ntptrace**. If the machine **ntptrace** is run on is not authorized to get time from one of the servers, **ntptrace** will show a time-out, even though the servers in the chain may have the necessary access permission. Because **ntptrace** uses normal NTP packets (mode 3), rather than NTP queries (mode 6), or control requests (mode 7), it is less likely that this will be a problem (since few sites restrict time requests).

The following is an example of **ntptrace** output:

```
localhost: stratum 6, offset -0.000063, synch distance 1.19437
ntphost1: stratum 5, offset 1.903098, synch distance 0.13986
ntphost2: stratum 4, offset 1.900733, synch distance 0.12984
ntphost3: stratum 3, offset -1.880003, synch distance 0.10143
ntphost4: stratum 2, offset 1.904045, synch distance 0.06825
ntphost5: stratum 1, offset 1.907003, synch distance 0.00797, refid
'TRUE'
```

The **ntptrace** output lists the client name, its stratum, its time offset from the local host, the synchronization distance, and the ID of the reference clock attached to a server, if one exists. The synchronization distance is a measure of clock accuracy, assuming that it has a correct time source. For the exact derivation, refer to the NTP specification.

INTERNET RESOURCES

The best source of basic information on NTP is the NTP Web site at http://www.ntp.org. Included on-line are the NTP manual pages and the NTP FAQ, at http://www.eecis.udel.edu/~ntp/ntpfaq/NTP-a-faq.htm.

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All included documents discuss the public domain NTP implementation but are nevertheless useful for an AIX environment as well.

More technical information can be found on the following sites:

- http://www.eecis.udel.edu/~mills/ntp.htm
- http://www.eecis.udel.edu/~mills/papers.htm
- http://www.eecis.udel.edu/~mills/reports.htm
- http://www.eecis.udel.edu/~mills/memos.htm

The following RFCs relate to NTP. These can be found in many places throughout the Internet, but are also available from the NTP home page:

- RFC-2783? – *Pulse-Per-Second API for Unix-like Operating Systems, Version 1.0* J Mogul, D Mills, J Brittenson, J Stone, U Wind (March 2000).
- RFC-2030? – *Simple Network Time Protocol (SNTP) Version 4 for IPv4, IPv6 and OSI* – Obsoletes RFC-1769 D Mills (October 1996).
- RFC-1769? – *Simple Network Time Protocol (SNTP)* ??? – Obsoletes RFC-1361 – Obsoleted by RFC-2030 D Mills (March 1995).
- RFC-1708? – *NTP PICS PROFORMA – For the Network Time Protocol Version 3* D Gowin (October 1994) ??.
- RFC-1589? – *A Kernel Model for Precision Timekeeping* D Mills (March 1994).
- RFC-1361? – *Simple Network Time Protocol (SNTP)* – Obsoleted by RFC-1769 D Mills (August 1992).
- RFC-1305? – *Network Time Protocol (Version 3) Specification, Implementation* – Obsoletes RFC-958, RFC-1059, RFC-1119 David L Mills (March 1992).
- RFC-1165? – *Network Time Protocol (NTP) over the OSI*

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Remote Operations Service J Crowcroft, J P Onions (June 1990).

- RFC-1129? – *Internet Time Synchronization: The Network Time Protocol* D L Mills (October 1989).
- RFC-1059? – *Network Time Protocol (Version 1) specification and implementation* – Obsoletes RFC-958 Obsoleted by RFC-1119, RFC-1305 D L Mills (July 1988).
- RFC-958? *Network Time Protocol (NTP)* – Obsoleted by RFC-1059, RFC-1119, RFC-1305 D L Mills (September 1985).
- RFC-868? – *Time Protocol* J Postel, K Harrenstien (May 1983).
- RFC-867? – *Daytime Protocol* J Postel (May 1983).

Sun Microsystems' staff have published a series of blueprints describing NTP theory, set up, and monitoring at http://www.sun.com/blueprints:

- *Using NTP to Control and Synchronize System Clocks – Part I: Introduction to NTP*.
- *Using NTP to Control and Synchronize System Clocks – Part II: Basic NTP Administration and Architecture*.
- *Using NTP to Control and Synchronize System Clocks – Part III: NTP Monitoring and Troubleshooting*.

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Using tape libraries with AIX – part 2

This month we conclude the shell script that adds a tapeutil management option to SMIT's top level menu.

```
sm_menu_opt:
      id_seq_num = ""
      id = "smc"
      next_id = "smc_query"
      text = ""
      text_msg_file = ""
      text_msg_set = Ø
      text_msg_id = Ø
      next_type = "n"
      alias = "y"
      help_msg_id = ""
      help_msg_loc = ""
      help_msg_base = ""
      help_msg_book = ""
sm_name_hdr:
      id = "smc_query"
      next_id = "smc_query_hdr"
      option_id = "smc_opt"
      has_name_select = "n"
      name = "Medium Changer"
      name_msg_file = ""
      name_msg_set = Ø
      name_msg_id = Ø
      type = ""
      ghost = "y"
      cmd_to_classify = ""
      cmd_to_classify_postfix = ""
      raw_field_name = "logicname"
      cooked_field_name = ""
      next_type = "d"
      help_msg_id = ""
      help_msg_loc = ""
      help_msg_base = ""
      help_msg_book = ""
sm_cmd_hdr:
      id = "smc_query_hdr"
      option_id = "smc_query_opt"
      has_name_select = "y"
      name = "Medium Changer List Command"
      name_msg_file = ""
      name_msg_set = Ø
      name_msg_id = Ø
```


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```
        cmd_to_exec = "tapeutil "
        ask = "n"
        exec_mode = ""
        ghost = "n"
        cmd_to_discover = ""
        cmd_to_discover_postfix = ""
        name_size = 0
        value_size = 0
        help_msg_id = ""
        help_msg_loc = ""
        help_msg_base = ""
        help_msg_book = ""
sm_cmd_opt:
        id_seq_num = "0"
        id = "rmt_opt"
        disc_field_name = "logicname"
        name = "Tape Drives and Medium Changers"
        name_msg_file = ""
        name_msg_set = 0
        name_msg_id = 0
        op_type = ""
        entry_type = ""
        entry_size = 0
        required = "y"
        prefix = "-f /dev/"
        cmd_to_list_mode = "1"
        cmd_to_list = "lsdev -Cc tape -S Available | sort -n -k 1.4"
        cmd_to_list_postfix = ""
        multi_select = ""
        value_index = 0
        disp_values = ""
        values_msg_file = ""
        values_msg_set = 0
        values_msg_id = 0
        aix_values = ""
        help_msg_id = ""
        help_msg_loc = ""
        help_msg_base = ""
        help_msg_book = ""
sm_cmd_opt:
        id_seq_num = "0"
        id = "smc_opt"
        disc_field_name = "logicname"
        name = "Medium Changer"
        name_msg_file = ""
        name_msg_set = 0
        name_msg_id = 0
        op_type = ""
        entry_type = ""
        entry_size = 0
```

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```
        required = "y"
        prefix = "-f /dev/"
        cmd_to_list_mode = "1"
        cmd_to_list = "lsdev -Cc tape -S Available | egrep '^smc|\.smc' |
sort -n -k 1.4"
        cmd_to_list_postfix = ""
        multi_select = ""
        value_index = Ø
        disp_values = ""
        values_msg_file = ""
        values_msg_set = Ø
        values_msg_id = Ø
        aix_values = ""
        help_msg_id = ""
        help_msg_loc = ""
        help_msg_base = ""
        help_msg_book = ""
sm_cmd_opt:
        id_seq_num = "Ø1Ø"
        id = "smc_query_opt"
        disc_field_name = "logicname"
        name = "Medium Changer"
        name_msg_file = ""
        name_msg_set = Ø
        name_msg_id = Ø
        op_type = ""
        entry_type = ""
        entry_size = Ø
        required = "y"
        prefix = "-f /dev/"
        cmd_to_list_mode = ""
        cmd_to_list = ""
        cmd_to_list_postfix = ""
        multi_select = ""
        value_index = Ø
        disp_values = ""
        values_msg_file = ""
        values_msg_set = Ø
        values_msg_id = Ø
        aix_values = ""
        help_msg_id = ""
        help_msg_loc = ""
        help_msg_base = ""
        help_msg_book = ""
sm_cmd_opt:
        id_seq_num = "Ø2Ø"
        id = "smc_query_opt"
        disc_field_name = ""
        name = "Selected Command"
        name_msg_file = ""
```


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```
        name_msg_set = Ø
        name_msg_id = Ø
        op_type = "r"
        entry_type = "n"
        entry_size = Ø
        required = "y"
        prefix = " "
        cmd_to_list_mode = ""
        cmd_to_list = ""
        cmd_to_list_postfix = ""
        multi_select = ""
        value_index = Ø
        disp_values = "elementinfo,inventory,Device IDs,Device Info"
        values_msg_file = ""
        values_msg_set = Ø
        values_msg_id = Ø
        aix_values = "elementinfo,inventory,devids,devinfo"
        help_msg_id = ""
        help_msg_loc = ""
        help_msg_base = ""
        help_msg_book = ""
sm_menu_opt:
        id_seq_num = "2ØØ2"
        id = "tapeutil"
        next_id = "smcpath"
        text = "Medium Changer Path Commands"
        text_msg_file = ""
        text_msg_set = Ø
        text_msg_id = Ø
        next_type = "m"
        alias = ""
        help_msg_id = ""
        help_msg_loc = ""
        help_msg_base = ""
        help_msg_book = ""
sm_menu_opt:
        id_seq_num = ""
        id = "smcpath"
        next_id = "smc_path"
        text = ""
        text_msg_file = ""
        text_msg_set = Ø
        text_msg_id = Ø
        next_type = "n"
        alias = "y"
        help_msg_id = ""
        help_msg_loc = ""
        help_msg_base = ""
        help_msg_book = ""
sm_name_hdr:
```

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```
        id = "smc_path"
        next_id = "smc_path_hdr"
        option_id = "smc_opt"
        has_name_select = "n"
        name = "Medium Changer"
        name_msg_file = ""
        name_msg_set = Ø
        name_msg_id = Ø
        type = ""
        ghost = "y"
        cmd_to_classify = ""
        cmd_to_classify_postfix = ""
        raw_field_name = "logicname"
        cooked_field_name = ""
        next_type = "d"
        help_msg_id = ""
        help_msg_loc = ""
        help_msg_base = ""
        help_msg_book = ""
sm_cmd_hdr:
        id = "smc_path_hdr"
        option_id = "smc_path_opt"
        has_name_select = "y"
        name = "Medium Changer Path Command"
        name_msg_file = ""
        name_msg_set = Ø
        name_msg_id = Ø
        cmd_to_exec = "tapeutil "
        ask = "y"
        exec_mode = ""
        ghost = "n"
        cmd_to_discover = ""
        cmd_to_discover_postfix = ""
        name_size = Ø
        value_size = Ø
        help_msg_id = ""
        help_msg_loc = ""
        help_msg_base = ""
        help_msg_book = ""
sm_cmd_opt:
        id_seq_num = "Ø1Ø"
        id = "smc_path_opt"
        disc_field_name = "logicname"
        name = "Medium Changer"
        name_msg_file = ""
        name_msg_set = Ø
        name_msg_id = Ø
        op_type = ""
        entry_type = ""
        entry_size = Ø
```


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```
        required = "y"
        prefix = "-f /dev/"
        cmd_to_list_mode = ""
        cmd_to_list = ""
        cmd_to_list_postfix = ""
        multi_select = ""
        value_index = 0
        disp_values = ""
        values_msg_file = ""
        values_msg_set = 0
        values_msg_id = 0
        aix_values = ""
        help_msg_id = ""
        help_msg_loc = ""
        help_msg_base = ""
        help_msg_book = ""
sm_cmd_opt:
        id_seq_num = "020"
        id = "smc_path_opt"
        disc_field_name = ""
        name = "Selected Path Command"
        name_msg_file = ""
        name_msg_set = 0
        name_msg_id = 0
        op_type = "r"
        entry_type = "n"
        entry_size = 0
        required = "y"
        prefix = " "
        cmd_to_list_mode = ""
        cmd_to_list = ""
        cmd_to_list_postfix = ""
        multi_select = ""
        value_index = 0
        disp_values = "query path,check path,enable primary,enable
alternate,disable primary,disable alternate,reset path"
        values_msg_file = ""
        values_msg_set = 0
        values_msg_id = 0
        aix_values = "qrypath,checkpath,enablepath' 'primary,enablepath'
'alternate,disablepath' 'primary,disablepath' 'alternate,resetpath"
        help_msg_id = ""
        help_msg_loc = ""
        help_msg_base = ""
        help_msg_book = ""
sm_menu_opt:
        id_seq_num = "2007"
        id = "tapeutil"
        next_id = "rmtrr"
        text = "Reservation For Exclusive Usage"
```

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```
      text_msg_file = ""
      text_msg_set = Ø
      text_msg_id = Ø
      next_type = "m"
      alias = ""
      help_msg_id = ""
      help_msg_loc = ""
      help_msg_base = ""
      help_msg_book = ""
sm_menu_opt:
      id_seq_num = ""
      id = "rmtrr"
      next_id = "rmt_rr"
      text = ""
      text_msg_file = ""
      text_msg_set = Ø
      text_msg_id = Ø
      next_type = "n"
      alias = "y"
      help_msg_id = ""
      help_msg_loc = ""
      help_msg_base = ""
      help_msg_book = ""
sm_name_hdr:
      id = "rmt_rr"
      next_id = "rmt_rr_hdr"
      option_id = "rmt_opt"
      has_name_select = "n"
      name = "Tape Drive"
      name_msg_file = ""
      name_msg_set = Ø
      name_msg_id = Ø
      type = ""
      ghost = "y"
      cmd_to_classify = ""
      cmd_to_classify_postfix = ""
      raw_field_name = "logicname"
      cooked_field_name = ""
      next_type = "d"
      help_msg_id = ""
      help_msg_loc = ""
      help_msg_base = ""
      help_msg_book = ""
sm_cmd_hdr:
      id = "rmt_rr_hdr"
      option_id = "rmt_rr_opt"
      has_name_select = "y"
      name = "Reservation For Exclusive Usage"
      name_msg_file = ""
      name_msg_set = Ø
```


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```
        name_msg_id = Ø
        cmd_to_exec = "tapeutil "
        ask = "y"
        exec_mode = ""
        ghost = "n"
        cmd_to_discover = ""
        cmd_to_discover_postfix = ""
        name_size = Ø
        value_size = Ø
        help_msg_id = ""
        help_msg_loc = ""
        help_msg_base = ""
        help_msg_book = ""
sm_cmd_opt:
        id_seq_num = "Ø1Ø"
        id = "rmt_rr_opt"
        disc_field_name = "logicname"
        name = "Tape Drive"
        name_msg_file = ""
        name_msg_set = Ø
        name_msg_id = Ø
        op_type = ""
        entry_type = ""
        entry_size = Ø
        required = "y"
        prefix = "-f /dev/"
        cmd_to_list_mode = ""
        cmd_to_list = ""
        cmd_to_list_postfix = ""
        multi_select = ""
        value_index = Ø
        disp_values = ""
        values_msg_file = ""
        values_msg_set = Ø
        values_msg_id = Ø
        aix_values = ""
        help_msg_id = ""
        help_msg_loc = ""
        help_msg_base = ""
        help_msg_book = ""
sm_cmd_opt:
        id_seq_num = "Ø2Ø"
        id = "rmt_rr_opt"
        disc_field_name = ""
        name = "Select Exclusive Usage To"
        name_msg_file = ""
        name_msg_set = Ø
        name_msg_id = Ø
        op_type = "r"
        entry_type = "n"
```

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```
        entry_size = Ø
        required = "y"
        prefix = " "
        cmd_to_list_mode = ""
        cmd_to_list = ""
        cmd_to_list_postfix = ""
        multi_select = ""
        value_index = Ø
        disp_values = "status,reserve,release"
        values_msg_file = ""
        values_msg_set = Ø
        values_msg_id = Ø
        aix_values = "status,reserve,release"
        help_msg_id = ""
        help_msg_loc = ""
        help_msg_base = ""
        help_msg_book = ""
sm_menu_opt:
        id_seq_num = "2ØØ9"
        id = "tapeutil"
        next_id = "rmtsense"
        text = "Show Sense Codes or Binary Information"
        text_msg_file = ""
        text_msg_set = Ø
        text_msg_id = Ø
        next_type = "m"
        alias = ""
        help_msg_id = ""
        help_msg_loc = ""
        help_msg_base = ""
        help_msg_book = ""
sm_menu_opt:
        id_seq_num = ""
        id = "rmtsense"
        next_id = "rmt_sense"
        text = ""
        text_msg_file = ""
        text_msg_set = Ø
        text_msg_id = Ø
        next_type = "n"
        alias = "y"
        help_msg_id = ""
        help_msg_loc = ""
        help_msg_base = ""
        help_msg_book = ""
sm_name_hdr:
        id = "rmt_sense"
        next_id = "rmt_sense_hdr"
        option_id = "rmt_opt"
        has_name_select = "n"
```


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```
        name = "Tape Drive"
        name_msg_file = ""
        name_msg_set = Ø
        name_msg_id = Ø
        type = ""
        ghost = "y"
        cmd_to_classify = ""
        cmd_to_classify_postfix = ""
        raw_field_name = "logicname"
        cooked_field_name = ""
        next_type = "d"
        help_msg_id = ""
        help_msg_loc = ""
        help_msg_base = ""
        help_msg_book = ""
sm_cmd_hdr:
        id = "rmt_sense_hdr"
        option_id = "rmt_sense_opt"
        has_name_select = "y"
        name = "Show Sense Codes or Binary Information"
        name_msg_file = ""
        name_msg_set = Ø
        name_msg_id = Ø
        cmd_to_exec = "x() \n\
{ \n\
        case \$3 in\n\
        reqsense|vpd)              tapeutil \$1 \$2 \$3 \n\
                                ;;\n\
        inquiry|logpage|modepage) tapeutil \$1 \$2 \$3 \$4 \n\
                                ;;\n\
        *)          echo ERROR in tapeutil . \$1 . \$2 . \$3 . \$4 \n\
                                ;;\n\
        esac
}\n\
x"
        ask = "n"
        exec_mode = ""
        ghost = "n"
        cmd_to_discover = ""
        cmd_to_discover_postfix = ""
        name_size = Ø
        value_size = Ø
        help_msg_id = ""
        help_msg_loc = ""
        help_msg_base = ""
        help_msg_book = ""
sm_cmd_opt:
        id_seq_num = "Ø1Ø"
        id = "rmt_sense_opt"
        disc_field_name = "logicname"
```

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```
        name = "Tape Drive"
        name_msg_file = ""
        name_msg_set = Ø
        name_msg_id = Ø
        op_type = ""
        entry_type = ""
        entry_size = Ø
        required = "y"
        prefix = "-f /dev/"
        cmd_to_list_mode = ""
        cmd_to_list = ""
        cmd_to_list_postfix = ""
        multi_select = ""
        value_index = Ø
        disp_values = ""
        values_msg_file = ""
        values_msg_set = Ø
        values_msg_id = Ø
        aix_values = ""
        help_msg_id = ""
        help_msg_loc = ""
        help_msg_base = ""
        help_msg_book = ""
sm_cmd_opt:
        id_seq_num = "Ø2Ø"
        id = "rmt_sense_opt"
        disc_field_name = ""
        name = "Issue SCSI Command To Show"
        name_msg_file = ""
        name_msg_set = Ø
        name_msg_id = Ø
        op_type = "r"
        entry_type = "n"
        entry_size = Ø
        required = "y"
        prefix = " "
        cmd_to_list_mode = ""
        cmd_to_list = ""
        cmd_to_list_postfix = ""
        multi_select = ""
        value_index = Ø
        disp_values = "inquiry data,log sense data,mode sense data,request
sense data,vital product data"
        values_msg_file = ""
        values_msg_set = Ø
        values_msg_id = Ø
        aix_values = "inquiry,logpage,modepage,reqsense,vpd"
        help_msg_id = ""
        help_msg_loc = ""
        help_msg_base = ""
```


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```
      help_msg_book = ""
sm_cmd_opt:
      id_seq_num = "Ø3Ø"
      id = "rmt_sense_opt"
      disc_field_name = ""
      name = "Selected Page (hex characters)"
      name_msg_file = ""
      name_msg_set = Ø
      name_msg_id = Ø
      op_type = ""
      entry_type = "t"
      entry_size = 2
      required = "n"
      prefix = " "
      cmd_to_list_mode = ""
      cmd_to_list = ""
      cmd_to_list_postfix = ""
      multi_select = ""
      value_index = Ø
      disp_values = ""
      values_msg_file = ""
      values_msg_set = Ø
      values_msg_id = Ø
      aix_values = ""
      help_msg_id = ""
      help_msg_loc = ""
      help_msg_base = ""
      help_msg_book = ""
sm_menu_opt:
      id_seq_num = "2ØØ1"
      id = "tapeutil"
      next_id = "smcaudit"
      text = "Medium Changer Audit Commands"
      text_msg_file = ""
      text_msg_set = Ø
      text_msg_id = Ø
      next_type = "m"
      alias = ""
      help_msg_id = ""
      help_msg_loc = ""
      help_msg_base = ""
      help_msg_book = ""
sm_menu_opt:
      id_seq_num = ""
      id = "smcaudit"
      next_id = "smc_audit"
      text = ""
      text_msg_file = ""
      text_msg_set = Ø
      text_msg_id = Ø
```

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```
      next_type = "n"
      alias = "y"
      help_msg_id = ""
      help_msg_loc = ""
      help_msg_base = ""
      help_msg_book = ""
sm_name_hdr:
      id = "smc_audit"
      next_id = "smc_audit_hdr"
      option_id = "smc_opt"
      has_name_select = "n"
      name = "Medium Changer"
      name_msg_file = ""
      name_msg_set = Ø
      name_msg_id = Ø
      type = ""
      ghost = "y"
      cmd_to_classify = ""
      cmd_to_classify_postfix = ""
      raw_field_name = "logicname"
      cooked_field_name = ""
      next_type = "d"
      help_msg_id = ""
      help_msg_loc = ""
      help_msg_base = ""
      help_msg_book = ""
sm_cmd_hdr:
      id = "smc_audit_hdr"
      option_id = "smc_audit_opt"
      has_name_select = "y"
      name = "Medium Changer Audit Command"
      name_msg_file = ""
      name_msg_set = Ø
      name_msg_id = Ø
      cmd_to_exec = "tapeutil "
      ask = "y"
      exec_mode = ""
      ghost = "n"
      cmd_to_discover = ""
      cmd_to_discover_postfix = ""
      name_size = Ø
      value_size = Ø
      help_msg_id = ""
      help_msg_loc = ""
      help_msg_base = ""
      help_msg_book = ""
sm_cmd_opt:
      id_seq_num = "ØØØ"
      id = "smc_audit_opt"
      disc_field_name = "logicname"
```


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```
        name = "Medium Changer"
        name_msg_file = ""
        name_msg_set = Ø
        name_msg_id = Ø
        op_type = ""
        entry_type = ""
        entry_size = Ø
        required = "y"
        prefix = "-f /dev/"
        cmd_to_list_mode = ""
        cmd_to_list = ""
        cmd_to_list_postfix = ""
        multi_select = ""
        value_index = Ø
        disp_values = ""
        values_msg_file = ""
        values_msg_set = Ø
        values_msg_id = Ø
        aix_values = ""
        help_msg_id = ""
        help_msg_loc = ""
        help_msg_base = ""
        help_msg_book = ""
sm_cmd_opt:
        id_seq_num = "Ø2Ø"
        id = "smc_audit_opt"
        disc_field_name = ""
        name = "Starting Address (all if missing)"
        name_msg_file = ""
        name_msg_set = Ø
        name_msg_id = Ø
        op_type = "l"
        entry_type = "#"
        entry_size = Ø
        required = "y"
        prefix = "audit "
        cmd_to_list_mode = "1"
        cmd_to_list = "callme() \n\
{       \n\
        tapeutil -f /dev/\$1 inventory 2>/dev/null | grep '^[A-Z]' | awk
'{if(NR>1)print \$NF,\"is a\",\$1,\$2}'\n\
} \n\
callme "
        cmd_to_list_postfix = "logicname"
        multi_select = ""
        value_index = Ø
        disp_values = ""
        values_msg_file = ""
        values_msg_set = Ø
        values_msg_id = Ø
```

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```
        aix_values = ""
        help_msg_id = ""
        help_msg_loc = ""
        help_msg_base = ""
        help_msg_book = ""
sm_cmd_opt:
        id_seq_num = "Ø3Ø"
        id = "smc_audit_opt"
        disc_field_name = ""
        name = "Number Of Elements (1 if missing)"
        name_msg_file = ""
        name_msg_set = Ø
        name_msg_id = Ø
        op_type = ""
        entry_type = "#"
        entry_size = Ø
        required = "n"
        prefix = " "
        cmd_to_list_mode = ""
        cmd_to_list = ""
        cmd_to_list_postfix = ""
        multi_select = ""
        value_index = Ø
        disp_values = ""
        values_msg_file = ""
        values_msg_set = Ø
        values_msg_id = Ø
        aix_values = ""
        help_msg_id = ""
        help_msg_loc = ""
        help_msg_base = ""
        help_msg_book = ""
sm_menu_opt:
        id_seq_num = "2ØØ3"
        id = "tapeutil"
        next_id = "smcmount"
        text = "Tape Mount to Drive"
        text_msg_file = ""
        text_msg_set = Ø
        text_msg_id = Ø
        next_type = "m"
        alias = ""
        help_msg_id = ""
        help_msg_loc = ""
        help_msg_base = ""
        help_msg_book = ""
sm_menu_opt:
        id_seq_num = ""
        id = "smcmount"
        next_id = "smc_mount"
```


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```
        text = ""
        text_msg_file = ""
        text_msg_set = Ø
        text_msg_id = Ø
        next_type = "n"
        alias = "y"
        help_msg_id = ""
        help_msg_loc = ""
        help_msg_base = ""
        help_msg_book = ""
sm_name_hdr:
        id = "smc_mount"
        next_id = "smc_mount_hdr"
        option_id = "rmt_clear_opt"
        has_name_select = "n"
        name = "Tape Drive to Work with"
        name_msg_file = ""
        name_msg_set = Ø
        name_msg_id = Ø
        type = ""
        ghost = "y"
        cmd_to_classify = ""
        cmd_to_classify_postfix = ""
        raw_field_name = "logicname"
        cooked_field_name = ""
        next_type = "d"
        help_msg_id = ""
        help_msg_loc = ""
        help_msg_base = ""
        help_msg_book = ""
sm_cmd_hdr:
        id = "smc_mount_hdr"
        option_id = "smc_mount_opt"
        has_name_select = "y"
        name = "Mount Tape From Slot"
        name_msg_file = ""
        name_msg_set = Ø
        name_msg_id = Ø
        cmd_to_exec = "tapeutil "
        ask = "y"
        exec_mode = ""
        ghost = "n"
        cmd_to_discover = ""
        cmd_to_discover_postfix = ""
        name_size = Ø
        value_size = Ø
        help_msg_id = ""
        help_msg_loc = ""
        help_msg_base = ""
        help_msg_book = ""
```

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```
sm_cmd_opt:
      id_seq_num = "Ø1Ø"
      id = "smc_mount_opt"
      disc_field_name = "logicname"
      name = "Tape Drive"
      name_msg_file = ""
      name_msg_set = Ø
      name_msg_id = Ø
      op_type = ""
      entry_type = ""
      entry_size = Ø
      required = "y"
      prefix = "-f /dev/"
      cmd_to_list_mode = ""
      cmd_to_list = ""
      cmd_to_list_postfix = ""
      multi_select = ""
      value_index = Ø
      disp_values = ""
      values_msg_file = ""
      values_msg_set = Ø
      values_msg_id = Ø
      aix_values = ""
      help_msg_id = ""
      help_msg_loc = ""
      help_msg_base = ""
      help_msg_book = ""
sm_cmd_opt:
      id_seq_num = "Ø3Ø"
      id = "smc_mount_opt"
      disc_field_name = ""
      name = "Slot Address"
      name_msg_file = ""
      name_msg_set = Ø
      name_msg_id = Ø
      op_type = "l"
      entry_type = "#"
      entry_size = Ø
      required = "y"
      prefix = "mount "
      cmd_to_list_mode = "1"
      cmd_to_list = "callme() \n\
{      \n\
      tapeutil -f /dev/\$1 inventory 2>/dev/null | grep -p 'Media
Present.*Yes'  | grep '^[A-Z]' | grep -v Drive | awk '{if(NR>1)print
\$NF,\"is a\",\$1,\$2}'\n\
} \n\
callme "
      cmd_to_list_postfix = "logicname"
      multi_select = ""
```


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```
        value_index = Ø
        disp_values = ""
        values_msg_file = ""
        values_msg_set = Ø
        values_msg_id = Ø
        aix_values = ""
        help_msg_id = ""
        help_msg_loc = ""
        help_msg_base = ""
        help_msg_book = ""
sm_cmd_opt:
        id_seq_num = "Ø"
        id = "rmt_clear_opt"
        disc_field_name = "logicname"
        name = "Empty Tape Drives"
        name_msg_file = ""
        name_msg_set = Ø
        name_msg_id = Ø
        op_type = ""
        entry_type = ""
        entry_size = Ø
        required = "y"
        prefix = "-f /dev/"
        cmd_to_list_mode = "1"
        cmd_to_list = "for tape in \$(lsdev -Cc tape -S Available | grep
rmt | awk '{print \$1}' ) ; do if [ \$(tapeutil -f /dev/\$tape status |
grep 'Medium Type' | awk '{print \$NF}' ) -eq Ø ] ; then lsdev -Cc tape
-l \$tape ; fi ; done | sort -n -k 1.4"
        cmd_to_list_postfix = ""
        multi_select = ""
        value_index = Ø
        disp_values = ""
        values_msg_file = ""
        values_msg_set = Ø
        values_msg_id = Ø
        aix_values = ""
        help_msg_id = ""
        help_msg_loc = ""
        help_msg_base = ""
        help_msg_book = ""
sm_menu_opt:
        id_seq_num = "2ØØ4"
        id = "tapeutil"
        next_id = "smcunmount"
        text = "Tape Unmount from Drive"
        text_msg_file = ""
        text_msg_set = Ø
        text_msg_id = Ø
        next_type = "m"
        alias = ""
```

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```
      help_msg_id = ""
      help_msg_loc = ""
      help_msg_base = ""
      help_msg_book = ""
sm_menu_opt:
      id_seq_num = ""
      id = "smcunmount"
      next_id = "smc_unmount"
      text = ""
      text_msg_file = ""
      text_msg_set = Ø
      text_msg_id = Ø
      next_type = "n"
      alias = "y"
      help_msg_id = ""
      help_msg_loc = ""
      help_msg_base = ""
      help_msg_book = ""
sm_name_hdr:
      id = "smc_unmount"
      next_id = "smc_unmount_hdr"
      option_id = "rmt_loaded_opt"
      has_name_select = "n"
      name = "Tape Drive to Work with"
      name_msg_file = ""
      name_msg_set = Ø
      name_msg_id = Ø
      type = ""
      ghost = "y"
      cmd_to_classify = ""
      cmd_to_classify_postfix = ""
      raw_field_name = "logicname"
      cooked_field_name = ""
      next_type = "d"
      help_msg_id = ""
      help_msg_loc = ""
      help_msg_base = ""
      help_msg_book = ""
sm_cmd_hdr:
      id = "smc_unmount_hdr"
      option_id = "smc_unmount_opt"
      has_name_select = "y"
      name = "Unmount Tape To Slot"
      name_msg_file = ""
      name_msg_set = Ø
      name_msg_id = Ø
      cmd_to_exec = "tapeutil "
      ask = "n"
      exec_mode = ""
      ghost = "n"
```


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```
        cmd_to_discover = ""
        cmd_to_discover_postfix = ""
        name_size = 0
        value_size = 0
        help_msg_id = ""
        help_msg_loc = ""
        help_msg_base = ""
        help_msg_book = ""
sm_cmd_opt:
        id_seq_num = "010"
        id = "smc_unmount_opt"
        disc_field_name = "logicname"
        name = "Tape Drive"
        name_msg_file = ""
        name_msg_set = 0
        name_msg_id = 0
        op_type = ""
        entry_type = ""
        entry_size = 0
        required = "y"
        prefix = "-f /dev/"
        cmd_to_list_mode = ""
        cmd_to_list = ""
        cmd_to_list_postfix = ""
        multi_select = ""
        value_index = 0
        disp_values = ""
        values_msg_file = ""
        values_msg_set = 0
        values_msg_id = 0
        aix_values = ""
        help_msg_id = ""
        help_msg_loc = ""
        help_msg_base = ""
        help_msg_book = ""
sm_cmd_opt:
        id_seq_num = "030"
        id = "smc_unmount_opt"
        disc_field_name = ""
        name = "Slot Address"
        name_msg_file = ""
        name_msg_set = 0
        name_msg_id = 0
        op_type = "l"
        entry_type = "#"
        entry_size = 0
        required = "y"
        prefix = "unmount "
        cmd_to_list_mode = "1"
        cmd_to_list = "callme() \n\
```

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```
{      \n\
      tapeutil -f /dev/\$1 inventory 2>/dev/null | grep -p 'Media
Present.*No'  | grep '^[A-Z]' | grep -v Drive | awk '{if(NR>1)print
\$NF,\"is a\",\$1,\$2}'\n\
} \n\
callme "
      cmd_to_list_postfix = "logicname"
      multi_select = ""
      value_index = Ø
      disp_values = ""
      values_msg_file = ""
      values_msg_set = Ø
      values_msg_id = Ø
      aix_values = ""
      help_msg_id = ""
      help_msg_loc = ""
      help_msg_base = ""
      help_msg_book = ""
sm_cmd_opt:
      id_seq_num = "Ø"
      id = "rmt_loaded_opt"
      disc_field_name = "logicname"
      name = "Tape Drives with Cartridges"
      name_msg_file = ""
      name_msg_set = Ø
      name_msg_id = Ø
      op_type = ""
      entry_type = ""
      entry_size = Ø
      required = "y"
      prefix = "-f /dev/"
      cmd_to_list_mode = "1"
      cmd_to_list = "for tape in \$(lsdev -Cc tape -S Available | grep
rmt | awk '{print \$1}' ) ; do if [ \$(tapeutil -f /dev/\$tape status |
grep 'Medium Type' | awk '{print \$NF}' ) -gt Ø ] ; then lsdev -Cc tape
-l \$tape ; fi ; done | sort -n -k 1.4"
      cmd_to_list_postfix = ""
      multi_select = ""
      value_index = Ø
      disp_values = ""
      values_msg_file = ""
      values_msg_set = Ø
      values_msg_id = Ø
      aix_values = ""
      help_msg_id = ""
      help_msg_loc = ""
      help_msg_base = ""
      help_msg_book = ""
sm_menu_opt:
      id_seq_num = "2ØØ5"
```


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```
        id = "tapeutil"
        next_id = "smcmove"
        text = "Medium Changer Moving Tapes"
        text_msg_file = ""
        text_msg_set = Ø
        text_msg_id = Ø
        next_type = "m"
        alias = ""
        help_msg_id = ""
        help_msg_loc = ""
        help_msg_base = ""
        help_msg_book = ""
sm_menu_opt:
        id_seq_num = ""
        id = "smcmove"
        next_id = "smc_move"
        text = ""
        text_msg_file = ""
        text_msg_set = Ø
        text_msg_id = Ø
        next_type = "n"
        alias = "y"
        help_msg_id = ""
        help_msg_loc = ""
        help_msg_base = ""
        help_msg_book = ""
sm_name_hdr:
        id = "smc_move"
        next_id = "smc_move_hdr"
        option_id = "smc_opt"
        has_name_select = ""
        name = "Medium Changer"
        name_msg_file = ""
        name_msg_set = Ø
        name_msg_id = Ø
        type = "j"
        ghost = "y"
        cmd_to_classify = ""
        cmd_to_classify_postfix = ""
        raw_field_name = "logicname"
        cooked_field_name = ""
        next_type = ""
        help_msg_id = ""
        help_msg_loc = ""
        help_msg_base = ""
        help_msg_book = ""
sm_cmd_hdr:
        id = "smc_move_hdr"
        option_id = "smc_move_opt"
        has_name_select = "y"
```

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```
      name = "Medium Changer Moving Tapes"
      name_msg_file = ""
      name_msg_set = Ø
      name_msg_id = Ø
      cmd_to_exec = "tapeutil "
      ask = ""
      exec_mode = ""
      ghost = ""
      cmd_to_discover = ""
      cmd_to_discover_postfix = ""
      name_size = Ø
      value_size = Ø
      help_msg_id = ""
      help_msg_loc = ""
      help_msg_base = ""
      help_msg_book = ""
sm_cmd_opt:
      id_seq_num = "ØØØ"
      id = "smc_move_opt"
      disc_field_name = "logicname"
      name = "Medium Changer"
      name_msg_file = ""
      name_msg_set = Ø
      name_msg_id = Ø
      op_type = ""
      entry_type = ""
      entry_size = Ø
      required = "y"
      prefix = "-f /dev/"
      cmd_to_list_mode = ""
      cmd_to_list = ""
      cmd_to_list_postfix = ""
      multi_select = ""
      value_index = Ø
      disp_values = ""
      values_msg_file = ""
      values_msg_set = Ø
      values_msg_id = Ø
      aix_values = ""
      help_msg_id = ""
      help_msg_loc = ""
      help_msg_base = ""
      help_msg_book = ""
sm_cmd_opt:
      id_seq_num = "Ø2Ø"
      id = "smc_move_opt"
      disc_field_name = ""
      name = "From Slot Number"
      name_msg_file = ""
      name_msg_set = Ø
```


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```
      name_msg_id = Ø
      op_type = "l"
      entry_type = "#"
      entry_size = Ø
      required = "+"
      prefix = "move "
      cmd_to_list_mode = "1"
      cmd_to_list = "callme() \n\
{      \n\
      tapeutil -f /dev/\$1 inventory 2>/dev/null | grep -p 'Media
Present.*Yes' | grep '^[A-Z]' | awk '{if(NR>1)print \$NF,\"is
a\",\$1,\$2}'\n\
} \n\
callme "
      cmd_to_list_postfix = "logicname"
      multi_select = ""
      value_index = Ø
      disp_values = ""
      values_msg_file = ""
      values_msg_set = Ø
      values_msg_id = Ø
      aix_values = ""
      help_msg_id = ""
      help_msg_loc = ""
      help_msg_base = ""
      help_msg_book = ""
sm_cmd_opt:
      id_seq_num = "Ø3Ø"
      id = "smc_move_opt"
      disc_field_name = ""
      name = "  To Slot Number"
      name_msg_file = ""
      name_msg_set = Ø
      name_msg_id = Ø
      op_type = "l"
      entry_type = "#"
      entry_size = Ø
      required = "+"
      prefix = " "
      cmd_to_list_mode = "1"
      cmd_to_list = "callme() \n\
{      \n\
      tapeutil -f /dev/\$1 inventory 2>/dev/null | grep -p 'Media
Present.*No'  | grep '^[A-Z]' | awk '{if(NR>1)print \$NF,\"is
a\",\$1,\$2}'\n\
} \n\
callme "
      cmd_to_list_postfix = "logicname"
      multi_select = ""
      value_index = Ø
```

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```
        disp_values = ""
        values_msg_file = ""
        values_msg_set = Ø
        values_msg_id = Ø
        aix_values = ""
        help_msg_id = ""
        help_msg_loc = ""
        help_msg_base = ""
        help_msg_book = ""
sm_cmd_opt:
        id_seq_num = "Ø"
        id = "libaddr_opt"
        disc_field_name = "slotnumber"
        name = "Library Addresses"
        name_msg_file = ""
        name_msg_set = Ø
        name_msg_id = Ø
        op_type = "l"
        entry_type = ""
        entry_size = Ø
        required = "+"
        prefix = " "
        cmd_to_list_mode = "1"
        cmd_to_list = "callme() \n\
{       \n\
        tapeutil -f /dev/\$1 inventory 2>/dev/null | grep '^[A-Z]' | awk
'{if(NR>1)print \$NF,\"is a\",\$1,\$2}'\n\
} \n\
callme "
        cmd_to_list_postfix = "logicname"
        multi_select = ""
        value_index = Ø
        disp_values = ""
        values_msg_file = ""
        values_msg_set = Ø
        values_msg_id = Ø
        aix_values = ""
        help_msg_id = ""
        help_msg_loc = ""
        help_msg_base = ""
        help_msg_book = ""
sm_menu_opt:
        id_seq_num = "2ØØ6"
        id = "tapeutil"
        next_id = "smcexch"
        text = "Medium Changer Exchanging Tapes"
        text_msg_file = ""
        text_msg_set = Ø
        text_msg_id = Ø
        next_type = "m"
```


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```
        alias = ""
        help_msg_id = ""
        help_msg_loc = ""
        help_msg_base = ""
        help_msg_book = ""
sm_menu_opt:
        id_seq_num = ""
        id = "smcexch"
        next_id = "smc_exch"
        text = ""
        text_msg_file = ""
        text_msg_set = Ø
        text_msg_id = Ø
        next_type = "n"
        alias = "y"
        help_msg_id = ""
        help_msg_loc = ""
        help_msg_base = ""
        help_msg_book = ""
sm_name_hdr:
        id = "smc_exch"
        next_id = "smc_exch_hdr"
        option_id = "smc_opt"
        has_name_select = "n"
        name = "Medium Changer"
        name_msg_file = ""
        name_msg_set = Ø
        name_msg_id = Ø
        type = ""
        ghost = "y"
        cmd_to_classify = ""
        cmd_to_classify_postfix = ""
        raw_field_name = "logicname"
        cooked_field_name = ""
        next_type = "d"
        help_msg_id = ""
        help_msg_loc = ""
        help_msg_base = ""
        help_msg_book = ""
sm_cmd_hdr:
        id = "smc_exch_hdr"
        option_id = "smc_exch_opt"
        has_name_select = "y"
        name = "Medium Changer Exchanging Tapes"
        name_msg_file = ""
        name_msg_set = Ø
        name_msg_id = Ø
        cmd_to_exec = "tapeutil "
        ask = "n"
        exec_mode = ""
```

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```
        ghost = "n"
        cmd_to_discover = ""
        cmd_to_discover_postfix = ""
        name_size = Ø
        value_size = Ø
        help_msg_id = ""
        help_msg_loc = ""
        help_msg_base = ""
        help_msg_book = ""
sm_cmd_opt:
        id_seq_num = "Ø1Ø"
        id = "smc_exch_opt"
        disc_field_name = "logicname"
        name = "Medium Changer"
        name_msg_file = ""
        name_msg_set = Ø
        name_msg_id = Ø
        op_type = ""
        entry_type = ""
        entry_size = Ø
        required = "y"
        prefix = "-f /dev/"
        cmd_to_list_mode = ""
        cmd_to_list = ""
        cmd_to_list_postfix = ""
        multi_select = ""
        value_index = Ø
        disp_values = ""
        values_msg_file = ""
        values_msg_set = Ø
        values_msg_id = Ø
        aix_values = ""
        help_msg_id = ""
        help_msg_loc = ""
        help_msg_base = ""
        help_msg_book = ""
sm_cmd_opt:
        id_seq_num = "Ø2Ø"
        id = "smc_exch_opt"
        disc_field_name = "slotnumber"
        name = "Insert Tape From Slot Number"
        name_msg_file = ""
        name_msg_set = Ø
        name_msg_id = Ø
        op_type = "l"
        entry_type = "#"
        entry_size = Ø
        required = "+"
        prefix = "exchange "
        cmd_to_list_mode = "1"
```


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```
      cmd_to_list = "callme() \n\
{      \n\
      tapeutil -f /dev/\$1 inventory 2>/dev/null | grep -p 'Media
Present.*Yes'  | grep '^[A-Z]' | awk '{if(NR>1)print \$NF,\"is
a\",\$1,\$2}'\n\
} \n\
callme "
      cmd_to_list_postfix = "logicname"
      multi_select = ""
      value_index = Ø
      disp_values = ""
      values_msg_file = ""
      values_msg_set = Ø
      values_msg_id = Ø
      aix_values = ""
      help_msg_id = ""
      help_msg_loc = ""
      help_msg_base = ""
      help_msg_book = ""
sm_cmd_opt:
      id_seq_num = "Ø3Ø"
      id = "smc_exch_opt"
      disc_field_name = "slotnumber"
      name = "Into The Slot Number"
      name_msg_file = ""
      name_msg_set = Ø
      name_msg_id = Ø
      op_type = "l"
      entry_type = "#"
      entry_size = Ø
      required = "+"
      prefix = " "
      cmd_to_list_mode = "1"
      cmd_to_list = "callme() \n\
{      \n\
      tapeutil -f /dev/\$1 inventory 2>/dev/null | grep '^[A-Z]' | awk
'{if(NR>1)print \$NF,\"is a\",\$1,\$2}'\n\
} \n\
callme "
      cmd_to_list_postfix = "logicname"
      multi_select = ""
      value_index = Ø
      disp_values = ""
      values_msg_file = ""
      values_msg_set = Ø
      values_msg_id = Ø
      aix_values = ""
      help_msg_id = ""
      help_msg_loc = ""
      help_msg_base = ""
```

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```
      help_msg_book = ""
sm_cmd_opt:
      id_seq_num = "Ø4Ø"
      id = "smc_exch_opt"
      disc_field_name = "slotnumber"
      name = "After Moving Any Present Tape To Slot"
      name_msg_file = ""
      name_msg_set = Ø
      name_msg_id = Ø
      op_type = "l"
      entry_type = "#"
      entry_size = Ø
      required = "+"
      prefix = " "
      cmd_to_list_mode = "1"
      cmd_to_list = "callme() \n\
{      \n\
      tapeutil -f /dev/\$1 inventory 2>/dev/null | grep -p 'Media
Present.*No'  | grep '^[A-Z]' | awk '{if(NR>1)print \$NF,\"is
a\",\$1,\$2}'\n\
} \n\
callme "
      cmd_to_list_postfix = "logicname"
      multi_select = ""
      value_index = Ø
      disp_values = ""
      values_msg_file = ""
      values_msg_set = Ø
      values_msg_id = Ø
      aix_values = ""
      help_msg_id = ""
      help_msg_loc = ""
      help_msg_base = ""
      help_msg_book = ""
***
/usr/bin/odmadd /tmp/smitty.add
return=$?
/usr/bin/rm -f /tmp/smitty.add
##############################################################################
# Allow easy removal of the new menu entries
##############################################################################
cat <<*** >$HOME/not$NAME
ODMDIR=/usr/lib/objrepos
odmdelete -o sm_name_hdr -q id=smc_query
odmdelete -o sm_name_hdr -q id=smc_path
odmdelete -o sm_name_hdr -q id=rmt_rr
odmdelete -o sm_name_hdr -q id=rmt_sense
odmdelete -o sm_name_hdr -q id=smc_audit
odmdelete -o sm_name_hdr -q id=smc_mount
odmdelete -o sm_name_hdr -q id=smc_unmount
```


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```
odmdelete -o sm_name_hdr -q id=smc_move
odmdelete -o sm_name_hdr -q id=smc_exch
odmdelete -o sm_cmd_hdr -q id=smc_query_hdr
odmdelete -o sm_cmd_hdr -q id=smc_path_hdr
odmdelete -o sm_cmd_hdr -q id=rmt_rr_hdr
odmdelete -o sm_cmd_hdr -q id=rmt_sense_hdr
odmdelete -o sm_cmd_hdr -q id=smc_audit_hdr
odmdelete -o sm_cmd_hdr -q id=smc_mount_hdr
odmdelete -o sm_cmd_hdr -q id=smc_unmount_hdr
odmdelete -o sm_cmd_hdr -q id=smc_move_hdr
odmdelete -o sm_cmd_hdr -q id=smc_exch_hdr
odmdelete -o sm_cmd_opt -q id=rmt_opt
odmdelete -o sm_cmd_opt -q id=rmt_clear_opt
odmdelete -o sm_cmd_opt -q id=rmt_loaded_opt
odmdelete -o sm_cmd_opt -q id=smc_opt
odmdelete -o sm_cmd_opt -q id=smc_query_opt
odmdelete -o sm_cmd_opt -q id=smc_path_opt
odmdelete -o sm_cmd_opt -q id=rmt_rr_opt
odmdelete -o sm_cmd_opt -q id=rmt_sense_opt
odmdelete -o sm_cmd_opt -q id=smc_mount_opt
odmdelete -o sm_cmd_opt -q id=smc_unmount_opt
odmdelete -o sm_cmd_opt -q id=smc_audit_opt
odmdelete -o sm_cmd_opt -q id=smc_move_opt
odmdelete -o sm_cmd_opt -q id=libaddr_opt
odmdelete -o sm_cmd_opt -q id=smc_exch_opt
odmdelete -o sm_menu_opt -q next_id=tapeutil
odmdelete -o sm_menu_opt -q next_id=smc
odmdelete -o sm_menu_opt -q next_id=smc_query
odmdelete -o sm_menu_opt -q next_id=smcpath
odmdelete -o sm_menu_opt -q next_id=smc_path
odmdelete -o sm_menu_opt -q next_id=rmtrr
odmdelete -o sm_menu_opt -q next_id=rmt_rr
odmdelete -o sm_menu_opt -q next_id=rmtsense
odmdelete -o sm_menu_opt -q next_id=rmt_sense
odmdelete -o sm_menu_opt -q next_id=smcaudit
odmdelete -o sm_menu_opt -q next_id=smcmount
odmdelete -o sm_menu_opt -q next_id=smcunmount
odmdelete -o sm_menu_opt -q next_id=smc_audit
odmdelete -o sm_menu_opt -q next_id=smcmove
odmdelete -o sm_menu_opt -q next_id=smc_move
odmdelete -o sm_menu_opt -q next_id=smc_move_hdr
odmdelete -o sm_menu_opt -q next_id=smcexch
odmdelete -o sm_menu_opt -q next_id=smc_exch
odmdelete -o sm_menu_opt -q id=smcmount
odmdelete -o sm_menu_opt -q id=smcunmount
***
chmod a+x $HOME/not$NAME
echo "\n\tThe menus will be removed by \"$HOME/not$NAME\".\n"
##############################################################################
echo "\tThe fastpath to your application is \"$NAME\"."
```

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```
#########################################################################
echo "\tThe fastpath to the applications menu is \"apps\"."
echo "\tThe fastpath to all tapeutil commands is \"tapeutil\"."
echo "\tThe fastpath to the smc query commands is \"smc\"."
echo "\tThe fastpath to the smc audit command is \"smcaudit\"."
echo "\tThe fastpath to the smc mount command is \"smcmount\"."
echo "\tThe fastpath to the smc unmount command is \"smcunmount\"."
echo "\tThe fastpath to the smc move command is \"smcmove\"."
echo "\tThe fastpath to the smc exchange command is \"smcexch\"."
echo "\tThe fastpath to the tape reserve commands is \"smcrr\"."
echo "\tThe fastpath to the sense code command menu is \"rmcsense\"."
exit $return
```

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PROFI Engineering Systems (Germany) © Dr Andreas Neuper 2003

Shell script library

INTRODUCTION

As in C programming, a shell script can make use of a predefined library that would contain variable and function definitions. The attached library listing includes the following functions:

- IsNumeric
- IsInteger
- IsReal
- CheckDateFormat
- FormatDate
- AddDayToDate.

INCLUSION OF A LIBRARY IN A SCRIPT

The library must be included in the current shell as follows:

```
#  at the beginning of script, use the . command to include the
#  library in the current shell
 .  library.ksh
```

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BUILD ON THE CURRENT LIBRARY

There are six functions defined in this library. The definition of these functions can be expanded to implement further requirements.

For example:

```
AddDayToDate  < date>   < days  to  added or  subtracted >
```

where *date* must be in the format DDMMYYYY and *days* must be a positive or negative integer.

Now the constraint on input date format can be expanded to include the following formats:

- YYYYMMDD
- DD-MON-YYYYY

Using a similar algorithm, you can develop a function called AddMonToDate and so on.

LIBRARY.KSH

```
#! /bin/ksh
###############################################################################
#  Name     : library.ksh
#  Overview : The script is a library of functions.
#  Notes    : 1. The following functions are included in the script:
#                 o IsNumeric
#                 o IsInteger
#                 o IsReal
#                 o CheckDateFormat
#                 o FormatDate
#                 o AddDayToDate
#             2. Functions return either $TRUE, $FALSE, NULL or a value.
#             3. These functions will display error message(s) if the
#                calling script defines and exports following variable
#                as follows:
#                           export DEBUG=Ø
###############################################################################
#  Name     : InitialiseVariables
#  Overview : The function initializes variables.
#  Input    :
#  Returns  :
#  Notes    : 1. This is a function internal to the library.
###############################################################################
```

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```
InitialiseVariables ()
{
# return codes
TRUE=Ø
FALSE=1
META_CHARS="\"*:;%^/|!&()=_\\#@$£><'\`"
FUNCTION=""
MODULE="library.ksh"
INFO="${MODULE}:INFO:"
ERROR="${MODULE}:\${FUNCTION}:ERROR:"
NULL_STRING="Empty string"
NULL_DATE_STRING="Empty date string"
NULL_NO_DAYS="No of days is null"
NULL_FORMAT_STRING="Empty date format string"
NULL_FROM_DATE_FORMAT="Empty from date format string"
INVALID_FROM_DATE_FORMAT="Invalid from date format"
INVALID_TO_DATE_FORMAT="Invalid to date format"
NULL_TO_DATE_FORMAT="Empty to date format string"
META_CHARS_IN_STRING="String contains meta character\(s\)"
INVALID_FIRST_CHAR_IN_STRING="First charater in string is invalid"
INVALID_CHAR_IN_STRING="String contains non numeric characters"
STRING_NOT_NUMERIC="String contains non-numeric characters"
NO_DECIMAL_PLACES="String contains no decimal places"
TOO_MANY_DECIMAL_POINTS="String contains too many decimal points"
DECIMAL_POINT_MISSING="String contains no decimal point"
INVALID_MONTH="Invalid month"
INVALID_DAY="Invalid day"
TOO_MANY_DIGITS="Date contains too many digits"
NOT_ENOUGH_DIGITS="Date contains not enough digits"
INVALID_DATE_FORMAT="Invalid required date format"
INVALID_LEN_FOR_NEGATIVE_INT="Negative integer must of length 2 or more"
INVALID_NO_ARGS="Invalid number of arguments supplied"
}
##############################################################################
#  Name     : DisplayMessage
#  Overview : The function displays message
#  Input    : 1. Message type (E = Error, I = Informative)
#             2. Error Code as defined in DefineMessages ().
#  Notes    : 1. This is an internal function to the library.
##############################################################################
DisplayMessage ( )
{
MESSAGE_TYPE=$1
MESSAGE_TEXT='eval echo $2'
# re-evaluate $ERROR  prefix
ERROR='eval echo ${ERROR} | sed s/://'
# display message
echo "${ERROR}${MESSAGE_TEXT}"
# re-initialize $FUNCTION
FUNCTION=""
```


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```
# re-define $ERROR prefix
ERROR="${MODULE}:\${FUNCTION}:ERROR:"
}
##############################################################################
#  Name     : IsNumeric
#  Overview : The function validates a string for being numeric.
#  Input    : string
#  Returns  : TRUE   if string contains numeric characters only
#             FALSE  otherwise
#  Usage    : if ! IsNumeric     99x
#             then
#                 echo "String is not numeric"
#             fi
#  Notes    : 1. A numeric string will only contain digits Ø to 9
#                (eg 12345 88900 098763 00000)
##############################################################################
IsNumeric ()
{
# define function name
FUNCTION="${FUNCTION}:IsNumeric"
# assign parameter
P_STRING="$1"
# validate against null
if  [ "${P_STRING}"  = "" ]
then
    if [ "${DEBUG}" = "${TRUE}" ]
    then
        DisplayMessage E "${NULL_STRING}"
    fi
    return $FALSE
fi
# look for unwanted characters
LEN_BEFORE_P_STRING='echo "${P_STRING}\c" | wc -c'
LEN_AFTER_P_STRING='echo "${P_STRING}\c" | tr -d "${META_CHARS}"  |\
                                                    wc -c'
if [ $LEN_BEFORE_P_STRING -ne $LEN_AFTER_P_STRING ]
then
    if [ "${DEBUG}" = "${TRUE}" ]
    then
        DisplayMessage E "${META_CHARS_IN_STRING}"
    fi
    return $FALSE
fi
# examine each character
LEN_P_STRING='echo "${P_STRING}\c" | wc -c'
COLUMN_POS=1
while [ $COLUMN_POS -le $LEN_P_STRING  ]
do
  NEXT_CHAR='echo "${P_STRING}" | cut -c${COLUMN_POS}-${COLUMN_POS}'
  if [ "${NEXT_CHAR}" != "Ø" -a  \
```

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```
       "${NEXT_CHAR}" != "1" -a "${NEXT_CHAR}"   != "2" -a  \
       "${NEXT_CHAR}" != "3" -a "${NEXT_CHAR}"   != "4" -a  \
       "${NEXT_CHAR}" != "5" -a "${NEXT_CHAR}"   != "6" -a  \
       "${NEXT_CHAR}" != "7" -a "${NEXT_CHAR}"   != "8" -a  \
       "${NEXT_CHAR}" != "9"  ]
  then
         if [ "${DEBUG}" = "${TRUE}"  ]
         then
              DisplayMessage E "${STRING_NOT_NUMERIC}"
         fi
         return ${FALSE}
  fi
  COLUMN_POS='expr $COLUMN_POS + 1'
done
FUNCTION=""
return $TRUE
}
##############################################################################
#  Name     : IsReal
#  Overview : The function validates a string for being a real number.
#  Input    : string
#  Returns  : TRUE   if string is a real number
#             FALSE  otherwise
#  Usage    : if !  IsReal   100
#             then
#                  echo "Invalid real number"
#             fi
#  Notes    :1. The range of real number is
#                -0.1  to 99999999.99999999
#            2. Examples
#                Positive  real numbers = 0.0,  1.2 ,  2.333   4.5566
#                Negative  real numbers = -0.0, -1.2 , -2.333  -4.5566
##############################################################################
IsReal ()
{
# define function name
FUNCTION="${FUNCTION}:IsReal"
# assign parameter
P_STRING="$1"
# validate against null
if  [ "${P_STRING}"  = "" ]
then
    if [ "${DEBUG}" = "${TRUE}" ]
    then
        DisplayMessage E "${NULL_STRING}"
    fi
    return $FALSE
fi
NEGATIVE_REAL_NUMBER="${FALSE}"
# check for meta characters
```


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```
LEN_BEFORE_P_STRING='echo "${P_STRING}\c" | wc -c'
LEN_AFTER_P_STRING='echo "${P_STRING}\c" | tr -d "${META_CHARS}"  |\
                                                    wc -c'
if [ $LEN_BEFORE_P_STRING -ne $LEN_AFTER_P_STRING ]
then
    if [ "${DEBUG}" = "${TRUE}" ]
    then
        DisplayMessage E "${META_CHARS_IN_STRING}"
    fi
    return $FALSE
fi
# examine each character
LEN_P_STRING='echo "${P_STRING}\c" | wc -c'
COLUMN_POS=1
while [ $COLUMN_POS -le $LEN_P_STRING  ]
do
  NEXT_CHAR='echo "${P_STRING}" | cut -c${COLUMN_POS}-${COLUMN_POS}'
  if [ $COLUMN_POS -eq  1 ]
  then
     # consider - sign and allowed characters
     if [ "${NEXT_CHAR}" != "-" -a "${NEXT_CHAR}"   != "Ø" -a  \
          "${NEXT_CHAR}" != "1" -a "${NEXT_CHAR}"   != "2" -a  \
          "${NEXT_CHAR}" != "3" -a "${NEXT_CHAR}"   != "4" -a  \
          "${NEXT_CHAR}" != "5" -a "${NEXT_CHAR}"   != "6" -a  \
          "${NEXT_CHAR}" != "7" -a "${NEXT_CHAR}"   != "8" -a  \
          "${NEXT_CHAR}" != "9" -a "${NEXT_CHAR}"   != "."    ]
    then
         if [ "${DEBUG}" = "${TRUE}"  ]
         then
              DisplayMessage E "${INVALID_FIRST_CHAR_IN_STRING}"
         fi
         return ${FALSE}
    elif [  "${NEXT_CHAR}"  = "-"  ]
    then
          NEGATIVE_REAL_NUMBER=${TRUE}
    fi
  else
     # consider allowed characters
     if [ "${NEXT_CHAR}" != "Ø" -a  \
          "${NEXT_CHAR}" != "1" -a "${NEXT_CHAR}"   != "2" -a  \
          "${NEXT_CHAR}" != "3" -a "${NEXT_CHAR}"   != "4" -a  \
          "${NEXT_CHAR}" != "5" -a "${NEXT_CHAR}"   != "6" -a  \
          "${NEXT_CHAR}" != "7" -a "${NEXT_CHAR}"   != "8" -a  \
          "${NEXT_CHAR}" != "9" -a "${NEXT_CHAR}"   != "."  ]
    then
         if [ "${DEBUG}" = "${TRUE}"  ]
         then
              DisplayMessage E "${INVALID_CHAR_IN_STRING}"
         fi
         return $FALSE
```

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```
     fi
  fi
  COLUMN_POS='expr $COLUMN_POS + 1'
done
# string must contain one decimal point
LEN_BEFORE_P_STRING='echo "${P_STRING}\c" | wc -c'
LEN_AFTER_P_STRING='echo "${P_STRING}\c" | tr -d "."  | wc -c'
#
if [ 'expr $LEN_BEFORE_P_STRING - $LEN_AFTER_P_STRING' -eq Ø    ]
then #
     # number does not contain decimal points
     if [ "${DEBUG}" = "${TRUE}"  ]
     then
          DisplayMessage E "${DECIMAL_POINT_MISSING}"
     fi
     return $FALSE
elif [ 'expr $LEN_BEFORE_P_STRING - $LEN_AFTER_P_STRING' -gt 1    ]
then #
     # number contain too many decimal points
     if [ "${DEBUG}" = "${TRUE}"  ]
     then
          DisplayMessage E "${TOO_MANY_DECIMAL_POINTS}"
     fi
     return $FALSE
fi
# number must have at least one decimal place ( eg. 1.2 )
DECIMAL_PARTS='echo "${P_STRING}" | cut -d'.' -f2'
if [ 'echo "${DECIMAL_PARTS}\c" | wc -c'   -lt 1   ]
then #
     # number does not contain minimum number of decimal places
     if [ "${DEBUG}" = "${TRUE}"  ]
     then
          DisplayMessage E "${NO_DECIMAL_PLACES}"
     fi
     return $FALSE
fi
FUNCTION=""
return $TRUE
}
################################################################################
#  Name     : IsInteger
#  Overview : The function validates a string for being an integer.
#  Input    : string
#  Returns  : TRUE   if string is an integer
#             FALSE  otherwise
#  Usage    : if  ! IsInteger   12.22
#             then
#                  echo "Invalid integer"
#             fi
#  Notes    : 1.  The valid integer range is
```


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```
#                  -1  to  99999999 (whatever is allowed by ksh)
#             2. Examples
#                 Positive integers  =  Ø, 1,  2, 8888
#                 Negative integers  =  -Ø, -1,  -22, -8888
###############################################################################
IsInteger ()
{
FUNCTION="${FUNCTION}:IsInteger"
# assign parameter
P_STRING="$1"
# validate against null
if  [ "${P_STRING}"  = "" ]
then
    if [ "${DEBUG}" = "${TRUE}" ]
    then
        DisplayMessage E "${NULL_STRING}"
    fi
    return $FALSE
fi
LEN_BEFORE_P_STRING='echo "${P_STRING}\c" | wc -c'
LEN_AFTER_P_STRING='echo "${P_STRING}\c" | tr -d "${META_CHARS}"  |\
                                                    wc -c'
if [ $LEN_BEFORE_P_STRING -ne $LEN_AFTER_P_STRING ]
then
    if [ "${DEBUG}" = "${TRUE}" ]
    then
        DisplayMessage E "${META_CHARS_IN_STRING}"
    fi
    return $FALSE
fi
LEN_P_STRING='echo "${P_STRING}\c" | wc -c'
# examine each character
NEGATIVE_INTEGER=${FALSE}
COLUMN_POS=1
while [ $COLUMN_POS -le $LEN_P_STRING  ]
do
  NEXT_CHAR='echo "${P_STRING}" | cut -c${COLUMN_POS}-${COLUMN_POS}'
  if [ $COLUMN_POS -eq  1 ]
  then
     # consider - sign and allowed characters
     if [ "${NEXT_CHAR}" != "-" -a "${NEXT_CHAR}"   != "Ø" -a  \
          "${NEXT_CHAR}" != "1" -a "${NEXT_CHAR}"   != "2" -a  \
          "${NEXT_CHAR}" != "3" -a "${NEXT_CHAR}"   != "4" -a  \
          "${NEXT_CHAR}" != "5" -a "${NEXT_CHAR}"   != "6" -a  \
          "${NEXT_CHAR}" != "7" -a "${NEXT_CHAR}"   != "8" -a  \
          "${NEXT_CHAR}" != "9"  ]
    then
         if [ "${DEBUG}" = "${TRUE}"  ]
         then
              DisplayMessage E "${INVALID_FIRST_CHAR_IN_STRING}"
```

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```
        fi
        return ${FALSE}
    elif [  "${NEXT_CHAR}"  = "-"  ]
    then
         NEGATIVE_INTEGER=${TRUE}
    fi
  else
```

Editor's note: this article will be concluded next month.

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ETL Developer (UK)
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Brio has announced its Performance Suite 8.1 with support for AIX, HP-UX, and Solaris and localized Windows versions in nine languages.

It promises enhanced Web-based application services by supporting Apache 1.3 or higher, Sun ONE Application Server, WebLogic 6.x SP3 or higher, and WebSphere 4.0.3 or higher.

The nine localized languages supported include Chinese - Simplified and Traditional, French, German, Italian, Japanese, Korean, Portuguese Brazilian, and Spanish.

For further information contact:
Brio, 4980 Great America Parkway, Santa Clara, CA 95054, USA.
Tel: (408) 496 7400.
URL: http://www.brio.com/products/brio_performance_suite/.

* * *

Gresham Computing has announced that ADIC customers can now implement Tivoli Storage Manager (TSM) LAN-free software using Gresham's Enterprise DistribuTape (EDT) tape storage management integration application.

EDT works with the Tivoli Storage Manager and ADIC's storage networking library architecture to provide high performance SAN back-up that shares resources, reduces network congestion, and simplifies management, giving better data protection.

The software provides a range of LAN-free features and library management functionality for ADIC libraries operating in TSM back-up environments.

It manages communications between TSM and the library or media manager and augments TSM's native support for ADIC libraries with an array of feature enhancements, which allow multiple TSM servers and LAN-Free clients to share multiple tape drives dynamically and streamline media management processes.

The software is certified and supported by Tivoli Storage Software and can be purchased through Gresham or IBM and its Business Partners. Supported platforms include AIX, Solaris, HP-UX, and Windows NT and 2000. It's compatible with all ADIC AML, Scalar 10K, and Scalar 1000 storage networking libraries.

For further information contact:
Gresham, 28 Queen Street, London, EC4R 1BB, UK.
Tel: (020) 7653 0200.
URL: http://www.gresham-computing.com/storage.

* * *

Micromuse has announced Netcool/Precision for Transmission Networks Version 5.3, providing auto-discovery and dynamic topology/connectivity modelling of both IP and transmission networks. The expanded range now offers dynamic network asset and inventory management, topology visualization and mapping, and topology-based event correlation (RCA).

Netcool/Precision for Transmission Networks v5.3 runs on AIX.

For further information contact:
Micromuse, 139 Townsend St, San Francisco, CA 94107, USA
Tel: 415 538 9090.
URL: http://www.micromuse.com/products/exl/precision_tn.html.