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Text Part Number: 78EE117C99-34372576

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Ty Coon, President of Vice

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1.4 GCC Compiler ,GCC C++ run-time library and GCC STL - libs 3.2.1

1.4.1 Available under license :

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Version 2.1, February 1999

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This option is useful when you wish to copy part of the code of the Library into a program that is not a library.

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<signature of Ty Coon>, 1 April 1990
Ty Coon, President of Vice

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1.5 Kerberos (CablexChange) 5.0 :1.5.1

1.5.1 Available under license :

Kerberos Version 5, Release 1.5.1

Release Notes
The MIT Kerberos Team

Unpacking the Source Distribution

The source distribution of Kerberos 5 comes in a gzipped tarfile, krb5-1.5.1.tar.gz. Instructions on how to extract the entire distribution follow.

If you have the GNU tar program and gzip installed, you can simply do:

```
gtar xzpf krb5-1.5.1.tar.gz
```

If you don't have GNU tar, you will need to get the FSF gzip distribution and use gzcat:

```
gzcat krb5-1.5.1.tar.gz | tar xpf -
```

Both of these methods will extract the sources into krb5-1.5.1/src and the documentation into krb5-1.5.1/doc.

Building and Installing Kerberos 5

The first file you should look at is doc/install-guide.ps; it contains the notes for building and installing Kerberos 5. The info file krb5-install.info has the same information in info file format. You can view this using the GNU emacs info-mode, or by using the standalone info file viewer from the Free Software Foundation. This is also available as an HTML file, install.html.

Other good files to look at are admin-guide.ps and user-guide.ps,

which contain the system administrator's guide, and the user's guide, respectively. They are also available as info files `kerberos-admin.info` and `krb5-user.info`, respectively. These files are also available as HTML files.

If you are attempting to build under Windows, please see the `src/windows/README` file. Note that this release might not build under Windows currently.

Reporting Bugs

Please report any problems/bugs/comments using the `krb5-send-pr` program. The `krb5-send-pr` program will be installed in the `sbin` directory once you have successfully compiled and installed Kerberos V5 (or if you have installed one of our binary distributions).

If you are not able to use `krb5-send-pr` because you haven't been able to compile and install Kerberos V5 on any platform, you may send mail to `krb5-bugs@mit.edu`.

You may view bug reports by visiting

<http://krbdev.mit.edu/rt/>

and logging in as "guest" with password "guest".

Major changes in 1.5.1

The only significant change in `krb5-1.5.1` is to fix the security vulnerabilities described in MITKRB5-SA-2006-001, which are local privilege escalation vulnerabilities in applications running on Linux and AIX.

krb5-1.5.1 changes by ticket ID

Listed below are the RT tickets of bugs fixed in `krb5-1.5.1`. Please see

<http://krbdev.mit.edu/rt/NoAuth/krb5-1.5/fixes-1.5.1.html>

for a current listing with links to the complete tickets.

- 3904 fix uninitialized vars
- 3956 gssapi compilation errors on Windows
- 3971 broken configure test for `dlopen`
- 3998 Document `add_entry` in `ktutil` man page

4012 reverse test for copy_oid_set in lib/gssapi/krb5/indicate_mechs.c
4036 reject configure option for static libraries
4037 respect LDFLAGS in NetBSD build
4063 gss mech glue implementation should validate opaque pointer types
4088 gss_import_name can fail to call gssint_initialize_library()
4125 fix MITKRB5-SA-2006-001: multiple local privilege escalation vulnerabilities
4137 ksu spuriously fails when exiting shell when ksu-ing to non-root
4168 clean up mkrel patchlevel.h editing etc.

Major changes in 1.5

Kerberos 5 Release 1.5 includes many significant changes to the Kerberos build system, to GSS-API, and to the Kerberos KDC and administration system. These changes build up infrastructure as part of our efforts to make Kerberos more extensible and flexible. While we are confident that these changes will improve Kerberos in the long run, significant code restructuring may introduce portability problems or change behavior in ways that break applications. It is always important to test a new version of critical security software like Kerberos before deploying it in your environment to confirm that the new version meets your environment's requirements. Because of the significant restructuring, it is more important than usual to perform this testing and to report problems you find.

Highlights of major changes include:

- * KDB abstraction layer, donated by Novell.
- * plug-in architecture, allowing for extension modules to be loaded at run-time.
- * multi-mechanism GSS-API implementation ("mechglue"), donated by Sun Microsystems
- * Simple and Protected GSS-API negotiation mechanism ("SPNEGO") implementation, donated by Sun Microsystems
- * Per-directory ChangeLog files have been deleted. Releases now include auto-generated revision history logs in the combined file doc/CHANGES.

Changes by ticket ID

Listed below are the RT tickets of bugs fixed in krb5-1.5. Please see

<http://krbdev.mit.edu/rt/NoAuth/krb5-1.5/fixes-1.5.html>

for a current listing with links to the complete tickets.

- 581 verify_krb_v4_tgt is not 64-bit clean
- 856 patch to add shared library support for BSD/OS 4
- 1245 source tree not 64-bit clean
- 1288 v4 ticket file format incompatibilities
- 1431 fix errno.h references for cygwin
- 1434 use win32 rename solution in rcache for cygwin
- 1988 profile library fails to handle space in front of comments
- 2577 [Russ Allbery] Bug#250966: /usr/sbin/klogind: Authorization behavior not fully documented
- 2615 Fwd: Patch for telnet / telnetd to avoid crashes when used with MS kdc and PAC field
- 2628 Cygwin build patches
- 2648 [Russ Allbery] Bug#262192: libkrb53: krb_get_pw_in_tkt problems with AFS keys
- 2712 whitespace patch for src/kdc/kerberos_v4.c
- 2759 fake-getaddrinfo.h incorrectly checks for gethostbyname_r errors
- 2761 move getaddrinfo hacks into support lib for easier maintenance
- 2763 file ccache should be held open while scanning for credentials
- 2786 dead code in init_common() causes malloc(0)
- 2791 hooks for recording statistics on locking behavior
- 2807 Add VERSIONRC branding to krb5 support dll
- 2855 Possible thread safety issue in lib/krb5/os/def_realm.c
- 2856 Need a function to clone krb5_context structs for thread safe apps
- 2863 windows klist won't link
- 2880 fix calling convention for thread support fns
- 2882 Windows 2003 SP1 ktpass.exe generate keytab files fail to load with 1.4
- 2886 krb5_do_preauth could attempt to free NULL pointer
- 2931 implement SPNEGO
- 2932 implement multi-mech GSSAPI
- 2933 plug-in architecture
- 2936 supplementary error strings
- 2959 profile library should check high-resolution timestamps if available
- 2979 threaded test program built even with thread support disabled
- 3008 Incorrect cross-references in man pages
- 3010 Minor path and service man page fixes
- 3011 krb5-config should never return -I/usr/include
- 3013 Man pages for fakeka and krb524init
- 3014 texinfo variable fixes, info dir entries
- 3030 Bug report: Kinit has no support for addresses in credentials. Kinit -a is not enabled.
- 3065 Implement RFC 3961 PRF
- 3086 [Sergio Gelato] Bug#311977: libkrb53: gss_init_sec_context sometimes fails to initialise output_token
- 3088 don't always require support library when building with sun cc

- 3122 fixes for AIX 5.2 select() and IPv4/IPv6 issues
- 3129 shlib build problems on HP-UX 10.20 with gcc-3.4.3
- 3233 kuserok needs to check for uid 99 on Mac OS X
- 3252 Tru64 compilation fails after k5-int.h/krb5.h changes
- 3266 Include errno.h in kdc/kerberos_v4.c
- 3268 kprop should fall back on port 754 rather than failing
- 3269 telnet help should connect to a host named help
- 3308 kadmin.local is killed due to segmentation fault when principal name argument is missing.
- 3332 don't destroy uninitialized rcache mutex in error cases
- 3358 krb5 doesn't build when pthread_mutexattr_setrobust_np is defined but not declared
- 3364 plugins should be thread-safe
- 3415 Windows 64-bit support
- 3416 tweak kdb interface for thread safety
- 3417 move/add thread support to support lib
- 3423 Add support for utmps interface on HP-UX 11.23
- 3426 trunk builds without thread support are not working
- 3434 sizeof type should be checked at compile time, not configure time
- 3438 enhancement: report errno when generic I/O errors happen in kinit
- 3445 args to ctype.h macros should be cast to unsigned char, not int
- 3466 ioctl header portability fixes for telnet on GNU/kFreeBSD
- 3467 Allow GSS_C_NO_OID in krb5_gss_canon_name
- 3468 udp_preference_limit typo in krb5.conf man page
- 3490 getpwnam_r status checked incorrectly
- 3502 Cannot acquire initiator cred using gss_acquire_cred with explicit name on Windows
- 3512 updates to NSIS installer for KFW
- 3521 Add configurable Build value to File and Product versions for Windows
- 3549 library double-free with an empty keytab
- 3607 clients/ksu/setenv.c doesn't build on Solaris
- 3620 use strerror_r
- 3668 Prototype for krb5_c_prf missing const
- 3671 shsUpdate should take an unsigned int for length
- 3675 unsigned/signed int warnings in krb5_context variables.
- 3687 initialize cc_version to 0 not NULL
- 3688 Added CoreFoundation bundle plugin support
- 3689 build kadm5 headers in generate-files-mac target
- 3690 build rpc includes in generate-files-mac target.
- 3697 kadmin hangs indefinitely when admin princ has escaped chars
- 3706 ipv4+ipv6 messages can trip up KDC replay detection
- 3714 fix incorrect padata memory allocation in send_tgs.c
- 3716 Plugin search algorithm should take lists of name and directories
- 3719 fix bug in flag checking in libdb2 mpool code
- 3724 need to export kadm5_set_use_password_server
- 3736 Cleanup a number of cast away from const warnings in gssapi
- 3739 vsnprintf not present on windows
- 3746 krb5_cc_gen_new memory implementation doesn't create a new ccache

- 3761 combine kdc.conf, krb5.conf data in KDC programs
- 3783 install headers into include/krb5
- 3790 memory leak in GSSAPI credential releasing code
- 3791 memory leak in gss_krb5_set_allowable_ectypes error path
- 3825 krb5int_get_plugin_dir_data() uses + instead of * in realloc
- 3826 memory leaks in krb5kdc due to not freeing error messages
- 3854 CCAPI krb4int_save_credentials_addr should match prototype
- 3866 gld --as-needed not portable enough
- 3879 Update texinfo.tex
- 3888 ftpd's getline conflicts with current glibc headers
- 3898 Export gss_inquire_mechs_for_name for KFW
- 3899 Export krb5_gss_register_acceptor_identity in KFW
- 3900 update config.guess and config.sub
- 3902 g_userok.c has implicit declaration of strlen
- 3903 various kadm5 files need string.h
- 3905 warning fixes for spnego
- 3909 Plugins need to use RTLD_GROUP when available, but definitely not RTLD_GLOBAL
- 3910 fix parallel builds for libgss
- 3911 getaddrinfo code uses vars outside of storage duration
- 3918 fix warnings for lib/gssapi/mechglue/g_initialize.c
- 3920 cease export of krb5_gss_*
- 3921 remove unimplemented/unused mechglue functions
- 3922 mkrel should update patchlevel.h prior to reconf
- 3923 implement RFC4120 behavior on TCP requests with high bit set in length
- 3924 the krb5_get_server_rcache routine frees already freed memory in error path
- 3925 krb5_get_profile should reflect profile in the supplied context
- 3927 fix signedness warnings in spnego_mech.c
- 3928 fix typo in MS_BUG_TEST case in krb5_gss_glue.c
- 3940 Disable MSLSA: ccache in WOW64 on pre-Vista Beta 2 systems
- 3942 make gssint_get_mechanism match prototype
- 3944 write svn log output when building release
- 3945 mkrel should only generate doc/CHANGES for checkouts
- 3948 Windows: fix krb5.h generation
- 3949 fix plugin.c to compile on Windows
- 3950 autoconf 2.60 compatibility
- 3951 remove unused dlopen code in lib/gssapi/mechglue/g_initialize.c
- 3952 fix calling convention for krb5 error-message routines, document usage of krb5_get_error_message
- 3953 t_std_conf references private function due to explicit linking of init_os_ctx.o
- 3954 remove mechglue gss_config's gssint_userok and pname_to_uid
- 3957 remove unused lib/gssapi/mechglue/g_utils.c
- 3959 re-order inclusions in spnego_mech.c to avoid breaking system headers
- 3962 krb5_get_server_rcache double free
- 3964 "kdb5_util load" to existing db doesn't work, needed for kpropd
- 3968 fix memory leak in mechglue/g_init_sec_ctx.c

- 3970 test kdb5_util dump/load functionality in dejagnu
- 3972 make gss_unwrap match prototype
- 3974 work around failure to load into nonexistent db

Known bugs by ticket ID:

Listed below are the RT tickets for known bugs in krb5-1.5. Please see

<http://krbdev.mit.edu/rt/NoAuth/krb5-1.5/bugs-1.5.html>

for an up-to-date list, including links to the complete tickets.

- 3947 allow multiple calls to krb5_get_error_message to retrieve message
- 3956 gssapi compilation errors on Windows
- 3973 kdb5_util load now fails if db doesn't exist [workaround]

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lib/gssapi/generic/gssapi_err_generic.et
lib/gssapi/mechglue/g_accept_sec_context.c
lib/gssapi/mechglue/g_acquire_cred.c
lib/gssapi/mechglue/g_canon_name.c
lib/gssapi/mechglue/g_compare_name.c
lib/gssapi/mechglue/g_context_time.c
lib/gssapi/mechglue/g_delete_sec_context.c
lib/gssapi/mechglue/g_dsp_name.c
lib/gssapi/mechglue/g_dsp_status.c
lib/gssapi/mechglue/g_dup_name.c
lib/gssapi/mechglue/g_exp_sec_context.c
lib/gssapi/mechglue/g_export_name.c
lib/gssapi/mechglue/g_glue.c
lib/gssapi/mechglue/g_imp_name.c
lib/gssapi/mechglue/g_imp_sec_context.c
lib/gssapi/mechglue/g_init_sec_context.c
lib/gssapi/mechglue/g_initialize.c
lib/gssapi/mechglue/g_inq_context.c
lib/gssapi/mechglue/g_inq_cred.c
lib/gssapi/mechglue/g_inq_names.c
lib/gssapi/mechglue/g_process_context.c
lib/gssapi/mechglue/g_rel_buffer.c
lib/gssapi/mechglue/g_rel_cred.c
lib/gssapi/mechglue/g_rel_name.c
lib/gssapi/mechglue/g_rel_oid_set.c
lib/gssapi/mechglue/g_seal.c
lib/gssapi/mechglue/g_sign.c
lib/gssapi/mechglue/g_store_cred.c
lib/gssapi/mechglue/g_unseal.c
lib/gssapi/mechglue/g_verify.c

lib/gssapi/mechglue/mglueP.h
lib/gssapi/mechglue/oid_ops.c
lib/gssapi/spnego/gssapiP_spnego.h
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Acknowledgments

Thanks to Russ Allbery for contributing and integrating patches from Debian and other places.

Thanks to Michael Calmer for contributing patches for code clean-up.

Thanks to Novell for donating the KDB abstraction layer.

Thanks to Sun Microsystems for donating their implementations of mechglue and SPNEGO.

Thanks to the numerous others who reported bugs and/or contributed patches.

Thanks to the members of the Kerberos V5 development team at MIT, both past and present: Danilo Almeida, Jeffrey Altman, Richard Basch, Jay Berkenbilt, Mitch Berger, Andrew Boardman, Joe Calzaretta, John Carr, Don Davis, Alexandra Ellwood, Nancy Gilman, Matt Hancher, Sam Hartman,

Paul Hill, Marc Horowitz, Eva Jacobus, Miroslav Jurisic, Barry Jaspán,
Geoffrey King, John Kohl, Peter Litwack, Scott McGuire, Kevin
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/*

* lib/krb5/krb/cp_key_cnt.c

```

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*
*
* krb5_copy_keyblock()
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LZMA SDK 4.21

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LZMA SDK provides developers with documentation, source code, and sample code necessary to write software that uses LZMA compression.

LZMA is default and general compression method of 7z format in 7-Zip compression program (www.7-zip.org). LZMA provides high compression ratio and very fast decompression.

LZMA is an improved version of famous LZ77 compression algorithm. It was improved in way of maximum increasing of compression ratio, keeping high decompression speed and low memory requirements for decompressing.

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LZMA SDK Contents

LZMA SDK includes:

- C++ source code of LZMA Encoder and Decoder
- C++ source code for file->file LZMA compressing and decompressing
- ANSI-C compatible source code for LZMA decompressing
- Compiled file->file LZMA compressing/decompressing program for Windows system

ANSI-C LZMA decompression code was ported from original C++ sources to C. Also it was simplified and optimized for code size. But it is fully compatible with LZMA from 7-Zip.

UNIX/Linux version

To compile C++ version of file->file LZMA, go to directory SRC/7zip/Compress/LZMA_Alone and type "make" or "make clean all" to recompile all.

In some UNIX/Linux versions you must compile LZMA with static libraries. To compile with static libraries, change string in makefile

LIB = -lm

to string

LIB = -lm -static

Files

SRC - directory with source code
lzma.txt - LZMA SDK description (this file)
7zFormat.txt - 7z Format description
7zC.txt - 7z ANSI-C Decoder description (this file)
methods.txt - Compression method IDs for .7z
LGPL.txt - GNU Lesser General Public License
CPL.html - Common Public License
lzma.exe - Compiled file->file LZMA encoder/decoder for Windows
history.txt - history of the LZMA SDK

Source code structure

SRC

Common - common files for C++ projects

Windows - common files for Windows related code

7zip - files related to 7-Zip Project

Common - common files for 7-Zip

Compress - files related to compression/decompression

LZ - files related to LZ (Lempel-Ziv) compression algorithm

BinTree - Binary Tree Match Finder for LZ algorithm

HashChain - Hash Chain Match Finder for LZ algorithm

Patricia - Patricia Match Finder for LZ algorithm

RangeCoder - Range Coder (special code of compression/decompression)

LZMA - LZMA compression/decompression on C++

LZMA_Alone - file->file LZMA compression/decompression

LZMA_C - ANSI-C compatible LZMA decompressor

LzmaDecode.h - interface for LZMA decoding on ANSI-C

LzmaDecode.c - LZMA decoding on ANSI-C (new fastest version)

LzmaDecodeSize.c - LZMA decoding on ANSI-C (old size-optimized version)

LzmaTest.c - test application that decodes LZMA encoded file

LzmaStateDecode.h - interface for LZMA decoding (State version)

LzmaStateDecode.c - LZMA decoding on ANSI-C (State version)

LzmaStateTest.c - test application (State version)

Branch - Filters for x86, IA-64, ARM, ARM-Thumb, PowerPC and SPARC code

Archive - files related to archiving

7z_C - 7z ANSI-C Decoder

Source code of LZMA SDK is only part of big 7-Zip project. That is why LZMA SDK uses such complex source code structure.

You can find ANSI-C LZMA decompressing code at folder

SRC/7zip/Compress/LZMA_C

7-Zip doesn't use that ANSI-C LZMA code and that code was developed specially for this SDK. And files from LZMA_C do not need files from other directories of SDK for compiling.

7-Zip source code can be downloaded from 7-Zip's SourceForge page:

<http://sourceforge.net/projects/sevenzip/>

LZMA Decompression features

- Variable dictionary size (up to 256 MB)
- Estimated compressing speed: about 500 KB/s on 1 GHz CPU
- Estimated decompressing speed:
 - 8-12 MB/s on 1 GHz Intel Pentium 3 or AMD Athlon
 - 500-1000 KB/s on 100 MHz ARM, MIPS, PowerPC or other simple RISC
- Small memory requirements for decompressing (8-32 KB + DictionarySize)

- Small code size for decompressing: 2-8 KB (depending from speed optimizations)

LZMA decoder uses only integer operations and can be implemented in any modern 32-bit CPU (or on 16-bit CPU with some conditions).

Some critical operations that affect to speed of LZMA decompression:

- 1) 32*16 bit integer multiply
- 2) Misspredicted branches (penalty mostly depends from pipeline length)
- 3) 32-bit shift and arithmetic operations

Speed of LZMA decompressing mostly depends from CPU speed. Memory speed has no big meaning. But if your CPU has small data cache, overall weight of memory speed will slightly increase.

How To Use

Using LZMA encoder/decoder executable

Usage: LZMA <e|d> inputFile outputFile [<switches>...]

e: encode file

d: decode file

b: Benchmark. There are two tests: compressing and decompressing with LZMA method. Benchmark shows rating in MIPS (million instructions per second). Rating value is calculated from measured speed and it is normalized with AMD Athlon XP CPU results. Also Benchmark checks possible hardware errors (RAM errors in most cases). Benchmark uses these settings:

(-a1, -d21, -fb32, -mfbt4). You can change only -d. Also you can change number of iterations. Example for 30 iterations:

LZMA b 30

Default number of iterations is 10.

<Switches>

-a{N}: set compression mode 0 = fast, 1 = normal, 2 = max
default: 2 (max)

d{N}: Sets Dictionary size - [0, 28], default: 23 (8MB)
The maximum value for dictionary size is 256 MB = 2²⁸ bytes.
Dictionary size is calculated as DictionarySize = 2^N bytes.

For decompressing file compressed by LZMA method with dictionary size $D = 2^N$ you need about D bytes of memory (RAM).

-fb{N}: set number of fast bytes - [5, 255], default: 128

Usually big number gives a little bit better compression ratio and slower compression process.

-lc{N}: set number of literal context bits - [0, 8], default: 3

Sometimes lc=4 gives gain for big files.

-lp{N}: set number of literal pos bits - [0, 4], default: 0

lp switch is intended for periodical data when period is equal 2^N . For example, for 32-bit (4 bytes) periodical data you can use lp=2. Often it's better to set lc0, if you change lp switch.

-pb{N}: set number of pos bits - [0, 4], default: 2

pb switch is intended for periodical data when period is equal 2^N .

-mf{MF_ID}: set Match Finder. Default: bt4.

Compression ratio for all bt* and pat* almost the same. Algorithms from hc* group doesn't provide good compression ratio, but they often works pretty fast in combination with fast mode (-a0). Methods from bt* group require less memory than methods from pat* group. Usually bt4 works faster than any pat*, but for some types of files pat* can work faster.

Memory requirements depend from dictionary size (parameter "d" in table below).

MF_ID	Memory	Description
bt2	$d * 9.5 + 1MB$	Binary Tree with 2 bytes hashing.
bt3	$d * 9.5 + 65MB$	Binary Tree with 2-3(full) bytes hashing.
bt4	$d * 9.5 + 6MB$	Binary Tree with 2-3-4 bytes hashing.
bt4b	$d * 9.5 + 34MB$	Binary Tree with 2-3-4(big) bytes hashing.
pat2r	$d * 26 + 1MB$	Patricia Tree with 2-bits nodes, removing.
pat2	$d * 38 + 1MB$	Patricia Tree with 2-bits nodes.
pat2h	$d * 38 + 77MB$	Patricia Tree with 2-bits nodes, 2-3 bytes hashing.
pat3h	$d * 62 + 85MB$	Patricia Tree with 3-bits nodes, 2-3 bytes hashing.
pat4h	$d * 110 + 101MB$	Patricia Tree with 4-bits nodes, 2-3 bytes hashing.
hc3	$d * 5.5 + 1MB$	Hash Chain with 2-3 bytes hashing.
hc4	$d * 5.5 + 6MB$	Hash Chain with 2-3-4 bytes hashing.

-eos: write End Of Stream marker. By default LZMA doesn't write eos marker, since LZMA decoder knows uncompressed size stored in .lzma file header.

-si: Read data from stdin (it will write End Of Stream marker).
-so: Write data to stdout

Examples:

1) LZMA e file.bin file.lzma -d16 -lc0

compresses file.bin to file.lzma with 64 KB dictionary ($2^{16}=64K$) and 0 literal context bits. -lc0 allows to reduce memory requirements for decompression.

2) LZMA e file.bin file.lzma -lc0 -lp2

compresses file.bin to file.lzma with settings suitable for 32-bit periodical data (for example, ARM or MIPS code).

3) LZMA d file.lzma file.bin

decompresses file.lzma to file.bin.

Compression ratio hints

Recommendations

To increase compression ratio for LZMA compressing it's desirable to have aligned data (if it's possible) and also it's desirable to locate data in such order, where code is grouped in one place and data is grouped in other place (it's better than such mixing: code, data, code, data, ...).

Using Filters

You can increase compression ratio for some data types, using special filters before compressing. For example, it's possible to increase compression ratio on 5-10% for code for those CPU ISAs: x86, IA-64, ARM, ARM-Thumb, PowerPC, SPARC.

You can find C/C++ source code of such filters in folder "7zip/Compress/Branch"

You can check compression ratio gain of these filters with such 7-Zip commands (example for ARM code):

No filter:

```
7z a a1.7z a.bin -m0=lzma
```

With filter for little-endian ARM code:

```
7z a a2.7z a.bin -m0=bc_arm -m1=lzma
```

With filter for big-endian ARM code (using additional Swap4 filter):

```
7z a a3.7z a.bin -m0=swap4 -m1=bc_arm -m2=lzma
```

It works in such manner:

Compressing = Filter_encoding + LZMA_encoding

Decompressing = LZMA_decoding + Filter_decoding

Compressing and decompressing speed of such filters is very high, so it will not increase decompressing time too much.

Moreover, it reduces decompression time for LZMA_decoding, since compression ratio with filtering is higher.

These filters convert CALL (calling procedure) instructions from relative offsets to absolute addresses, so such data becomes more compressible. Source code of these CALL filters is pretty simple (about 20 lines of C++), so you can convert it from C++ version yourself.

For some ISAs (for example, for MIPS) it's impossible to get gain from such filter.

LZMA compressed file format

Offset Size Description

0	1	Special LZMA properties for compressed data
1	4	Dictionary size (little endian)
5	8	Uncompressed size (little endian). -1 means unknown size
13		Compressed data

ANSI-C LZMA Decoder

~~~~~

To compile ANSI-C LZMA Decoder you can use one of the following files sets:

- 1) LzmaDecode.h + LzmaDecode.c + LzmaTest.c (fastest version)
- 2) LzmaDecode.h + LzmaDecodeSize.c + LzmaTest.c (old size-optimized version)
- 3) LzmaStateDecode.h + LzmaStateDecode.c + LzmaStateTest.c (zlib-like interface)

#### Memory requirements for LZMA decoding

-----

LZMA decoder doesn't allocate memory itself, so you must

allocate memory and send it to LZMA.

Stack usage of LZMA decoding function for local variables is not larger than 200 bytes.

How To decompress data

-----

LZMA Decoder (ANSI-C version) now supports 5 interfaces:

- 1) Single-call Decompressing
- 2) Single-call Decompressing with input stream callback
- 3) Multi-call Decompressing with output buffer
- 4) Multi-call Decompressing with input callback and output buffer
- 5) Multi-call State Decompressing (zlib-like interface)

Variant-5 is similar to Variant-4, but Variant-5 doesn't use callback functions.

Decompressing steps

-----

- 1) read LZMA properties (5 bytes):  
    unsigned char properties[LZMA\_PROPERTIES\_SIZE];
- 2) read uncompressed size (8 bytes, little-endian)
- 3) Decode properties:

```
CLzmaDecoderState state; /* it's 24-140 bytes structure, if int is 32-bit */
```

```
if (LzmaDecodeProperties(&state.Properties, properties, LZMA_PROPERTIES_SIZE) != LZMA_RESULT_OK)  
    return PrintError(rs, "Incorrect stream properties");
```

- 4) Allocate memory block for internal Structures:

```
state.Probs = (CProb *)malloc(LzmaGetNumProbs(&state.Properties) * sizeof(CProb));  
if (state.Probs == 0)  
    return PrintError(rs, kCantAllocateMessage);
```

LZMA decoder uses array of CProb variables as internal structure.

By default, CProb is unsigned\_short. But you can define `_LZMA_PROB32` to make it unsigned\_int. It can increase speed on some 32-bit CPUs, but memory usage will be doubled in that case.

- 5) Main Decompressing

You must use one of the following interfaces:

## 5.1 Single-call Decompressing

-----

When to use: RAM->RAM decompressing

Compile files: LzmaDecode.h, LzmaDecode.c

Compile defines: no defines

Memory Requirements:

- Input buffer: compressed size
- Output buffer: uncompressed size
- LZMA Internal Structures (~16 KB for default settings)

Interface:

```
int res = LzmaDecode(&state,
    inStream, compressedSize, &inProcessed,
    outputStream, outSize, &outProcessed);
```

## 5.2 Single-call Decompressing with input stream callback

-----

When to use: File->RAM or Flash->RAM decompressing.

Compile files: LzmaDecode.h, LzmaDecode.c

Compile defines: \_LZMA\_IN\_CB

Memory Requirements:

- Buffer for input stream: any size (for example, 16 KB)
- Output buffer: uncompressed size
- LZMA Internal Structures (~16 KB for default settings)

Interface:

```
typedef struct _CBuffer
{
    ILzmaInCallback InCallback;
    FILE *File;
    unsigned char Buffer[kInBufferSize];
} CBuffer;
```

```
int LzmaReadCompressed(void *object, const unsigned char **buffer, SizeT *size)
{
    CBuffer *bo = (CBuffer *)object;
    *buffer = bo->Buffer;
    *size = MyReadFile(bo->File, bo->Buffer, kInBufferSize);
    return LZMA_RESULT_OK;
}
```

```
CBuffer g_InBuffer;
```

```
g_InBuffer.File = inFile;
g_InBuffer.InCallback.Read = LzmaReadCompressed;
int res = LzmaDecode(&state,
    &g_InBuffer.InCallback,
```

```
outStream, outSize, &outProcessed);
```

### 5.3 Multi-call decompressing with output buffer

-----

When to use: RAM->File decompressing

Compile files: LzmaDecode.h, LzmaDecode.c

Compile defines: `_LZMA_OUT_READ`

Memory Requirements:

- Input buffer: compressed size
- Buffer for output stream: any size (for example, 16 KB)
- LZMA Internal Structures (~16 KB for default settings)
- LZMA dictionary (dictionary size is encoded in stream properties)

Interface:

```
state.Dictionary = (unsigned char *)malloc(state.Properties.DictionarySize);
```

```
LzmaDecoderInit(&state);
```

```
do
```

```
{
```

```
    LzmaDecode(&state,  
              inBuffer, inAvail, &inProcessed,  
              g_OutBuffer, outAvail, &outProcessed);
```

```
    inAvail -= inProcessed;
```

```
    inBuffer += inProcessed;
```

```
}
```

```
while you need more bytes
```

see LzmaTest.c for more details.

### 5.4 Multi-call decompressing with input callback and output buffer

-----

When to use: File->File decompressing

Compile files: LzmaDecode.h, LzmaDecode.c

Compile defines: `_LZMA_IN_CB`, `_LZMA_OUT_READ`

Memory Requirements:

- Buffer for input stream: any size (for example, 16 KB)
- Buffer for output stream: any size (for example, 16 KB)
- LZMA Internal Structures (~16 KB for default settings)
- LZMA dictionary (dictionary size is encoded in stream properties)

Interface:

```
state.Dictionary = (unsigned char *)malloc(state.Properties.DictionarySize);
```

```
LzmaDecoderInit(&state);
```

```

do
{
  LzmaDecode(&state,
    &bo.InCallback,
    g_OutBuffer, outAvail, &outProcessed);
}
while you need more bytes

```

see LzmaTest.c for more details:

### 5.5 Multi-call State Decompressing (zlib-like interface)

-----  
When to use: file->file decompressing

Compile files: LzmaStateDecode.h, LzmaStateDecode.c

Compile defines:

Memory Requirements:

- Buffer for input stream: any size (for example, 16 KB)
- Buffer for output stream: any size (for example, 16 KB)
- LZMA Internal Structures (~16 KB for default settings)
- LZMA dictionary (dictionary size is encoded in stream properties)

Interface:

```
state.Dictionary = (unsigned char *)malloc(state.Properties.DictionarySize);
```

```

LzmaDecoderInit(&state);
do
{
  res = LzmaDecode(&state,
    inBuffer, inAvail, &inProcessed,
    g_OutBuffer, outAvail, &outProcessed,
    finishDecoding);
  inAvail -= inProcessed;
  inBuffer += inProcessed;
}
while you need more bytes

```

see LzmaStateTest.c for more details:

6) Free all allocated blocks

EXIT codes

-----

LZMA decoder can return one of the following codes:

```
#define LZMA_RESULT_OK 0
#define LZMA_RESULT_DATA_ERROR 1
```

If you use callback function for input data and you return some error code, LZMA Decoder also returns that code.

#### LZMA Defines

-----

`_LZMA_IN_CB` - Use callback for input data

`_LZMA_OUT_READ` - Use read function for output data

`_LZMA_LOC_OPT` - Enable local speed optimizations inside code.

`_LZMA_LOC_OPT` is only for `LzmaDecodeSize.c` (size-optimized version).

`_LZMA_LOC_OPT` doesn't affect `LzmaDecode.c` (speed-optimized version) and `LzmaStateDecode.c`

`_LZMA_PROB32` - It can increase speed on some 32-bit CPUs, but memory usage will be doubled in that case

`_LZMA_UINT32_IS_ULONG` - Define it if `int` is 16-bit on your compiler and `long` is 32-bit.

`_LZMA_SYSTEM_SIZE_T` - Define it if you want to use system's `size_t`. You can use it to enable 64-bit sizes supporting

#### C++ LZMA Encoder/Decoder

~~~~~

C++ LZMA code use COM-like interfaces. So if you want to use it, you can study basics of COM/OLE.

By default, LZMA Encoder contains all Match Finders.

But for compressing it's enough to have just one of them.

So for reducing size of compressing code you can define:

```
#define COMPRESS_MF_BT
```

```
#define COMPRESS_MF_BT4
```

and it will use only `bt4` match finder.

<http://www.7-zip.org>
<http://www.7-zip.org/support.html>

1.8 NetSNMP 5.0.9

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*
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*
* @author Vincent Rijmen <vincent.rijmen@esat.kuleuven.ac.be>
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1.10 OpenSSL 0.9.8

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1.11 regexp 3.8

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