Ultra Messaging (Version 6.14)

C Examples

Contents

Chapter 1

Introduction

This document lists and gives some background information on the C-language example UM programs.

For policies and procedures related to Ultra Messaging Technical Support, see `UM Support`.

See **UM Glossary** for Ultra Messaging terminology, abbreviations, and acronyms.

1.1   C Examples Introduction

These programs were written to help in troubleshooting, testing, and demonstrating UM coding techniques. See also `Java Example Source Code` and `C# Example Source Code`.

Since the tools are written to be useful as well as instructive, they are more complex than purely-instructive examples would be, with many options to add or subtract functionality. See `UMExamples` for purely-instructive examples of a variety of UM use cases.

The example C programs listed here are provided in both source form and in binary executable form.

1.2   Configuring C Examples

The example programs universally provide the "-c filename" command-line option. Using that option, the example application calls the **lbm_config()** API. However, note that this API is not recommended for use with XML-format LBM configuration files, largely because you are not able to specify an application name.

To use an XML configuration file with a UM example application, set the environment variables:

- LBM_XML_CONFIG_APPNAME - Desired name of application.

- LBM_XML_CONFIG_FILENAME - Path name of XML configuration file.

In this way, UM will correctly set the example application's name and will properly load the XML configuration file.

1.3   Building C Examples

Most users are not interested in compiling these sources in their current form, but instead use them for "spare parts", extracting fragments of code as appropriate. For users who wish to build the tools, and especially for users who may want to modify the tools, we recommend creating a new directory and copying all of the doc/example directory contents into that new directory.

The "Makefile.unix" is designed to be used by making a copy of the example directory under your binary package. For example:

```
$ cd $HOME/UMP_6.13
$ mkdir doc
$ mkdir doc/example
$ cd doc/example
$ cp $HOME/UM_6.13_doc/doc/example/* .
$ chmod +w *
$ make -f Makefile.unix TARGET_PLATFORM=Linux-glibc-2.17-x86_64 PRODUCT=UMP
```

Note

> For UM versions prior to 6.14, the above command might fail on versions of Linux that do not have the "libnsl.↩ so" library pre-installed. For example, CentOS 8. An easy workaround is to edit "Makefile.unix" and remove "-lnsl" from the LINUX_LIBS definition.

The Windows "nmake" file "Makefile.windows" is based on older versions of Visual Studio and may not be straightforward to make work as-is. It is still included for reference purposes. For example:

```
LBMSRC_OBJS = lbmsrc.obj verifymsg.obj getopt.obj
lbmsrc.exe:
```

indicates that the "lbmsrc.exe" program requires 3 source files: "lbmsrc.c", "verifymsg.c", and "getopt.c".

1.4   Unhandled C Events

Each of the example programs is written to demonstrate a subset of UM's total available functionality. For example, some programs are written to demonstrate **Streaming** functionality (e.g. lbmsrc), while other programs are written to

demonstrate **Persistence** functionality (e.g. umesrc), while still other programs are written to demonstrate **Queuing** functionality (e.g. umqsrc).

UM is generally designed to be event-driven, with events being delivered to the programs through standard callbacks, like source callbacks and receiver callbacks. There are many events which are common across all streaming, persistence, and queuing. Other events are specific to persistence, and still other events are specific to queuing.

This can lead to example programs reporting "unknown" or "unhandled" events. For example, if the "lbmsrc" streaming program is run with a configuration file that enables persistence, UM will deliver events that are specific to persistence to the "lbmsrc" program. But "lbmsrc" is designed for streaming, and does not include code cases for persistence or queuing events. Maybe you should change your configuration to disable persistence, or you should be using the "umesrc" example program.

Similarly, the "umqsrc" program expects queuing functionality, and can report unhandled events if persistence is configured. Or "umesrc" can report unhandled events if queuing is configured.

If you see an unhandled event, it is generally reported as a number. You can see which event this corresponds to by looking up the number in:

- **C Receiver Events** for subscribing programs and

- **C Source Events** for publishing programs.

Once you understand the nature of the unhandled event, you can decide how to change your configuration or choose a different program.

1.5   C Example Support Files

There are several source files in the example directory that contain useful functions to the main example programs.

getopt.c - utility functions to parse command-line options (for Windows).

verifymsg.c - utility function to help some programs create verifiable messages.

monmodopts.h - common include file used by many of the example programs. It includes option information for monitoring functionality.

replgetopt.h - common include file used by many of the example programs. It includes definitions for alternate getopt functions.

verifymsg.h - common include file used by many of the example programs. It includes definitions for "verifymsg.c" (which needs to be linked into many programs).

srs_monitor_info_msg.c - Module used by the srs_monitor_info_receiver program.

srs_monitor_info_msg.h - Definitions for srs_monitor_info_msg.c module.

srs_cmd_msg.c - Module used by the srs_cmd program.

srs_cmd_msg.h - Definitions for srs_cmd_msg.c module.

Makefile.unix - see contents for instructions of setting up environment variables.

Makefile.windows - see contents for instructions of setting up make variables.

lbmmondiag.pl - Reads UDP packets and process statistics. See lbmmonudp.c and lbmmondiag.pl in the UM Operations Guide.

1.6 Persistence Tutorial C Files

See **Demonstrating Persistence** for information on these files.

ume-example-src.c - Initial source application used in the tutorial.

ume-example-rcv.c - Initial receiver application used in the tutorial.

ume-example-src-2.c - Source application modified to use a UMP persistent store.

ume-example-rcv-2.c - Receiver application modified to use a UMP persistent store.

ume-example-src-3.c - Modified source application used to demonstrate persistence.

ume-example-rcv-3.c - Modified receiver application used to demonstrate persistence.

ume-example-config.xml - Elementary persistent store configuration file used for the tutorial.

1.7 C Examples

1.7.1 Example lbmhfrcv.c

Source code: lbmhfrcv.c

```
Purpose: application that receives messages from a given topic using a single
    hot-failover receiver.
Usage: lbmhfrcv [-AEhsvV] [-c filename] [-r msgs] [-U losslev] topic
      -A = display messages as ASCII text
      -c filename = Use LBM configuration file filename.
                    Multiple config files are allowed.
                    Example:  '-c file1.cfg -c file2.cfg'
      -d, --msec-delay=NUM        Implements a number of milliseconds sleep per message received
      -E = exit after source ends
      -h = help
      -r msgs = delete receiver after msgs messages
      -s = print statistics along with bandwidth
      -S = Exit after source ends, print throughput summary
      -v = be verbose about incoming messages (-v -v = be even more verbose)
      -V = verify message contents
```

1.7.2 Example lbmhfrcvq.c

Source code: lbmhfrcvq.c

```
Purpose: lbmhfrcv.c: application that receives messages from a given topic
    using a single hot-failover receiver and an event queue.
Usage: lbmhfrcvq [-EhsvV] [-c filename] [-r msgs] [-U losslev] topic
      -c filename = Use LBM configuration file filename.
                    Multiple config files are allowed.
                    Example:  '-c file1.cfg -c file2.cfg'
      -E = exit after source ends
```

```
    -h = help
    -r msgs = delete receiver after msgs messages
    -s = print statistics along with bandwidth
    -S = Exit after source ends, print throughput summary
    -U losslev = exit after losslev % unrecoverable loss
    -v = be verbose about incoming messages (-v -v = be even more verbose)
    -V = verify message contents
```

1.7.3 Example lbmhfsrc.c

Source code: lbmhfsrc.c

```
Purpose: application that sends to a given topic using a single hot-failover
    source.
Usage: lbmhfsrc [options] topic
Available options:
  -c filename = Use LBM configuration file filename.
               Multiple config files are allowed.
               Example:  '-c file1.cfg -c file2.cfg'
  -d delay = delay sending for delay seconds after source creation
  -h = help
  -i init = start at message init instead of 0
  -l len = send messages of len bytes
  -L linger = linger for linger seconds before closing context
  -M msgs = send msgs number of messages
  -N NUM = send on channel NUM
  -P msec = pause after each send msec milliseconds
  -R [UM]DATA/RETR = Set transport type to LBT-R[UM], set data rate limit to
                     DATA bits per second, and set retransmit rate limit to
                     RETR bits per second.  For both limits, the optional
                     k, m, and g suffixes may be used.  For example,
                     '-R 1m/500k' is the same as '-R 1000000/500000'
  -s sec = print stats every sec seconds
  -t filename = use filename contents as a recording of message sequence numbers
  -V = construct verifiable messages
  -x bits = Use 32 or 64 bits for hot-failover sequence numbers
```

1.7.4 Example lbmhfxrcv.c

Source code: lbmhfxrcv.c

```
Purpose: application that receives messages from a given topic using a single
    hot-failover receiver across contexts (HFX).
Usage: lbmhfxrcv [-aACdEfhqsSvV] [-I interface] [-c filename] [-r msgs] [-U losslev] topic
Available options:
  -a, --arrival-order  deliver messages in the order that they arrive.
  -A, --ascii          display messages as ASCII text (-A -A = newlines after each msg)
  -c, --config=FILE    Use LBM configuration file FILE.
                       Multiple config files are allowed.
                       Example: '-c file1.cfg -c file2.cfg'
  -C, --context-stats  fetch context rather than receiver stats
  -d, --deliver-dups   Enable duplicate delivery
  -E, --exit           exit when source stops sending
  -h, --help           display this help and exit
```

```
  -I, --iface=CIDR      create a context on the interface specified by CIDR
                        Multiple interfaces are allowed.
                        Example: '-I 10.29.1.0/24 -I 10.29.2.0/24'
  -q, --eventq          use an LBM event queue
  -r, --msgs=NUM        exit after NUM messages
  -O, --orderchecks      Enable message order checking
  -s, --stats=NUM       print LBM statistics every NUM seconds
  --max-sources=NUM     allow up to NUM sources (for statistics gathering purposes)
  -S, --stop            exit when source stops sending, and print throughput summary
  -U, --losslev=NUM     exit after NUM% unrecoverable loss
  -v, --verbose         be verbose about incoming messages (-v -v = be even more verbose)
  -V, --verify          verify message contents


Monitoring options:
  --monitor-rcv=NUM               monitor receiver every NUM seconds
  --monitor-ctx=NUM               monitor context every NUM seconds
  --monitor-transport=TRANS       use monitor transport module TRANS
                                  TRANS may be 'lbm', 'lbmsnmp', or 'udp', default is 'lbm'
  --monitor-transport-opts=OPTS   use OPTS as transport module options
  --monitor-format=FMT            use monitor format module FMT
                                  FMT may be 'csv' or 'pb'
  --monitor-format-opts=OPTS      use OPTS as format module options
  --monitor-appid=ID              use ID as application ID string


Transport and format options are passed as name=value pairs, separated by a semicolon.
The entire option string should be enclosed in double-quotes.


LBM transport options:
Note that individual LBM options can be specified as <scope>|<option>=value, where
  <scope> is one of context, source, receiver, wildcard_receiver, or event_queue
  <option> is the LBM configuration option name
The vertical bar (pipe symbol) is required when specifying individual LBM options.
  config=FILE           use LBM configuration file FILE
  topic=TOPIC           send statistics on topic TOPIC
                        default is /29west/statistics
  allow_debug=VAL       VAL may be 'off' or 'on'
                        defaults to 'off'


LBMSNMP transport options:
Note that individual LBM options can be specified as <scope>|<option>=value, where
  <scope> is one of context, source, receiver, wildcard_receiver, or event_queue
  <option> is the LBM configuration option name
The vertical bar (pipe symbol) is required when specifying individual LBM options.
  config=FILE           use LBM configuration file FILE
  topic=TOPIC           send statistics on topic TOPIC
                        default is /29west/statistics


UDP transport options:
  address=IP            send statistics to address IP
  port=NUM              send to UDP port NUM
                        default is 2933
  mcgroup=GRP           send on multicast group GRP
  bcaddress=IP          send statistics to broadcast address IP
  ttl=NUM               send multicast statistics with TTL NUM
                        default is 16


CSV format options:
  separator=CHAR        separate CSV fields with character CHAR
                        defaults to ','
                        Don't use a semicolon!


PB format options:
  filters=FILE          use FILE that contains filter options
```

1.7.5   Example lbmhtrcv.c

Source code: lbmhtrcv.c

```
Purpose: application that receives from a collection of HyperTopic patterns.
Usage: lbmhtrcv [options] <patterns_file
Where 'patterns_file' is a simple text file, supplied as standard input,
      containing one pattern per line.
Available options:
  -d msec             delete hypertopic receiver every msec milliseconds
  -h, --help          display this help and exit
  -p string           set hypertopic prefix to string
  -q                  use event queue
  -s, --statistics    print statistics along with bandwidth
  -v, --verbose       be verbose about incoming messages
  -x                  exit after all receivers deleted
```

1.7.6   Example lbmimsg.c

Source code: lbmimsg.c

```
Purpose: application that sends immediate messages (either unicast or multicsat)
    as fast as possible, either to a topic, or send topicless.
Usage: lbmimsg [options] topic
       lbmimsg [options] -o
Available options:
  -c filename = Use LBM configuration file filename.
                Multiple config files are allowed.
                Example:  '-c file1.cfg -c file2.cfg'
  -d delay = delay sending for delay seconds after source creation
  -h = help
  -l len = send messages of len bytes
  -L linger = linger for linger seconds before closing context
  -M msgs = send msgs number of messages
  -n num = Append a number between 1 and num to topic
  -o = send topic-less immediate messages
  -P msec = pause after each send msec milliseconds
  -R [UM]DATA/RETR = Set transport type to LBT-R[UM], set data rate limit to
                     DATA bits per second, and set retransmit rate limit to
                     RETR bits per second.  For both limits, the optional
                     k, m, and g suffixes may be used.  For example,
                     '-R 1m/500k' is the same as '-R 1000000/500000'
  -T target = target for unicast immediate messages
```

1.7.7   Example lbmireq.c

Source code: lbmireq.c

```
Purpose: application that sends immediate message requests (multicast or unicast)
```

```
     to a given topic and waits for responses.
Usage: lbmireq [-hv] [-c filename] [-l len] [-L linger] [-P sec] [-r rate/pct]
       [-R requests] [-T target] [topic]
       -c filename = Use LBM configuration file filename.
                     Multiple config files are allowed.
                     Example:  '-c file1.cfg -c file2.cfg'
       -h = help
       -l len = send messages of len bytes
       -L linger = linger for linger seconds before closing context
       -P sec = pause sec seconds after sending request for responses to arrive
       -r [UM]DATA/RETR = Set transport type to LBT-R[UM], set data rate limit to
                          DATA bits per second, and set retransmit rate limit to
                          RETR bits per second.  For both limits, the optional
                          k, m, and g suffixes may be used.  For example,
                          '-r 1m/500k' is the same as '-r 1000000/500000'
       -R requests = number of request messages to send
       -T target = send immediate request to target
       -v = be verbose (-v -v = be even more verbose)
```

1.7.8 Example lbmlatping.c

Source code: lbmlatping.c

```
Purpose: application to measure round-trip latency of SMX.  Use with lbmlatpong.
Usage: lbmlatping [-h] [-c filename] [-l len] [-P msec]
       -c filename = Use LBM configuration file filename.
                     Multiple config files are allowed.
                     Example:  '-c file1.cfg -c file2.cfg'
       -h = help
       -l len = use len length messages
       -P usec = pause after each send usec microseconds
                 (only accurate to milliseconds on windows)
```

1.7.9 Example lbmlatpong.c

Source code: lbmlatpong.c

```
Purpose: application to measure round-trip latency of SMX.  Use with lbmlatping.
Usage: lbmlatpong [-h] [-c filename]
       -c filename = Use LBM configuration file filename.
                     Multiple config files are allowed.
                     Example:  '-c file1.cfg -c file2.cfg'
       -h = help
```

1.7.10 Example lbmmon.c

Source code: lbmmon.c

```
Purpose: example LBM statistics monitoring application.
```

```
Usage: lbmmon [options]
Available options:
  -c, --config=FILE         Use LBM configuration file FILE.
                            Multiple config files are allowed.
                            Example:  '-c file1.cfg -c file2.cfg'
  -h, --help                display this help and exit
  -t, --transport=TRANS     use transport module TRANS
                            TRANS may be 'lbm', 'udp', or 'lbmsnmp', default is 'lbm'
      --transport-opts=OPTS use OPTS as transport module options
                            See the 'UM Operations Guide' section 'Monitoring Transport Modules'.
  -f, --format=FMT          use format module FMT
                            FMT may be 'csv' or 'pb'
      --format-opts=OPTS    use OPTS as format module options
                            See the 'UM Operations Guide' section 'Monitoring Format Modules'.


Transport and format options are passed as name=value pairs, separated by a semicolon.
The entire option string should be enclosed in double-quotes.


LBM transport options:
Note that individual LBM options can be specified as <scope>|<option>=value, where
  <scope> is one of context, source, receiver, wildcard_receiver, or event_queue
  <option> is the LBM configuration option name
The vertical bar (pipe symbol) is required when specifying individual LBM options.
  config=FILE           use LBM configuration file FILE
  topic=TOPIC           receive statistics on topic TOPIC
                        default is /29west/statistics
  wctopic=PATTERN       receive statistics on wildcard topic PATTERN
                        See  https://communities.informatica.com/infakb/faq/5/Pages/80075.aspx
                        for guidelines on using wildcard topics. Also make sure the statistics
                        topic namespace is disjoint from the data topic namespace.


LBMSNMP transport options:
Note that individual LBM options can be specified as <scope>|<option>=value, where
  <scope> is one of context, source, receiver, wildcard_receiver, or event_queue
  <option> is the LBM configuration option name
The vertical bar (pipe symbol) is required when specifying individual LBM options.
  config=FILE           use LBM configuration file FILE
  topic=TOPIC           receive statistics on topic TOPIC
                        default is /29west/statistics
  wctopic=PATTERN       receive statistics on wildcard topic PATTERN
                        See  https://communities.informatica.com/infakb/faq/5/Pages/80075.aspx
                        for guidelines on using wildcard topics. Also make sure the statistics
                        topic namespace is disjoint from the data topic namespace.


UDP transport options:
  port=NUM              receive on UDP port NUM
                        default is 2933
  interface=IP          receive multicast on interface IP
                        default is INADDR_ANY (0.0.0.0)
  mcgroup=GRP           receive on multicast group GRP


CSV format options:
  separator=CHAR        separate CSV fields with character CHAR
                        defaults to ','
                        Don't use a semicolon!
  passthrough=VAL       VAL may be 'off', 'on' or 'convert'
                        defaults to 'off'


PB format options:
  passthrough=VAL       VAL may be 'off', 'on' or 'convert'
                        defaults to 'off'
```

1.7.11   Example lbmmon_cmd.c

Source code: lbmmon_cmd.c

```
Purpose: send unicast immediate control requests to an LBMMON publisher.
Usage: lbmmon_cmd -T target_string -C command [options]
```

1.7.12   Example lbmmoncache.c

Source code: lbmmoncache.c

```
Purpose: example LBM statistics monitoring application.
Usage: lbmmoncache [options]
Available options:
  -c, --config=FILE          Use LBM configuration file FILE.
                             Multiple config files are allowed.
                             Example: '-c file1.cfg -c file2.cfg'
  -C, --cache-size=size      Set the cache size to 'size' entries
  -h, --help                 display this help and exit
  -t, --transport=TRANS      use transport module TRANS
                             TRANS may be 'lbm', 'udp', or 'lbmsnmp', default is 'lbm'
      --transport-opts=OPTS  use OPTS as transport module options
  -f, --format=FMT           use format module FMT
                             FMT may be 'csv'
      --format-opts=OPTS     use OPTS as format module options


Transport and format options are passed as name=value pairs, separated by a semicolon.
The entire option string should be enclosed in double-quotes.


LBM transport options:
Note that individual LBM options can be specified as <scope>|<option>=value, where
  <scope> is one of context, source, receiver, wildcard_receiver, or event_queue
  <option> is the LBM configuration option name
The vertical bar (pipe symbol) is required when specifying individual LBM options.
  config=FILE          use LBM configuration file FILE
  topic=TOPIC          receive statistics on topic TOPIC
                       default is /29west/statistics
  wctopic=PATTERN      receive statistics on wildcard topic PATTERN
                       See  https://communities.informatica.com/infakb/faq/5/Pages/80075.aspx
                       for guidelines on using wildcard topics. Also make sure the statistics
                       topic namespace is disjoint from the data topic namespace.


LBMSNMP transport options:
Note that individual LBM options can be specified as <scope>|<option>=value, where
  <scope> is one of context, source, receiver, wildcard_receiver, or event_queue
  <option> is the LBM configuration option name
The vertical bar (pipe symbol) is required when specifying individual LBM options.
  config=FILE          use LBM configuration file FILE
  topic=TOPIC          receive statistics on topic TOPIC
                       default is /29west/statistics
```

```
    wctopic=PATTERN          receive statistics on wildcard topic PATTERN
                             See  https://communities.informatica.com/infakb/faq/5/Pages/80075.aspx
                             for guidelines on using wildcard topics. Also make sure the statistics
                             topic namespace is disjoint from the data topic namespace.


UDP transport options:
  port=NUM                   receive on UDP port NUM
                             default is 2933
  interface=IP               receive multicast on interface IP
                             default is INADDR_ANY (0.0.0.0)
  mcgroup=GRP                receive on multicast group GRP


CSV format options:
  separator=CHAR             separate CSV fields with character CHAR
                             defaults to ','
                             Don't use a semicolon!
  passthrough=VAL            VAL may be 'off', 'on' or 'convert'
                             defaults to 'off'


PB format options:
  passthrough=VAL            VAL may be 'off', 'on' or 'convert'
                             defaults to 'off'
```

1.7.13   Example lbmmondata.c

Source code: lbmmondata.c

```
Purpose: example LBM statistics monitoring application.
Usage: lbmmondata [-c filename] [-t topicname]
      -c filename = Use LBM configuration file filename.
                    Multiple config files are allowed.
                    Example:  '-c file1.cfg -c file2.cfg'
      -t topicname = use topic topicname to receive statistics
```

1.7.14   Example lbmmonudp.c

Source code: lbmmonudp.c

```
Purpose: application that receives LBM statistics and forwards as CSV over UDP.
Usage: lbmmonudp [options]
Available options:
  -3, --force-32bit          force all data values to fit within 32 bits
                             default is to use native data size
                             applies only to 64-bit platforms
  -a, --address=IP           send CSV data to unicast address IP
  -b, --broadcast=IP         send CSV data to broadcast address IP
  -f, --format=FMT           use monitor format module FMT
                             FMT may be 'csv'
      --format-opts=OPTS     use OPTS as format module options
  -h, --help                 display this help and exit
  -i, --interface=IP         send multicast via interface IP
  -m, --multicast=GRP        send CSV data to multicast group GRP
  -p, --port=NUM             send CSV data on UDP port NUM
```

```
                            default is port 1234
  -t, --transport=TRANS     use monitor transport module TRANS
                            TRANS may be 'lbm' or 'udp', default is 'lbm'
      --transport-opts=OPTS use OPTS as transport module options
  -T, --ttl=NUM             send multicast with TTL NUM
                            default is 1
```

```
Transport and format options are passed as name=value pairs, separated by a semicolon.
The entire option string should be enclosed in double-quotes.
```

```
LBM transport options:
Note that individual LBM options can be specified as <scope>|<option>=value, where
  <scope> is one of context, source, receiver, wildcard_receiver, or event_queue
  <option> is the LBM configuration option name
The vertical bar (pipe symbol) is required when specifying individual LBM options.
  config=FILE           use LBM configuration file FILE
  topic=TOPIC           receive statistics on topic TOPIC
                        default is /29west/statistics
  wctopic=PATTERN       receive statistics on wildcard topic PATTERN
                        See  https://communities.informatica.com/infakb/faq/5/Pages/80075.aspx
                        for guidelines on using wildcard topics. Also make sure the statistics
                        topic namespace is disjoint from the data topic namespace.
```

```
LBMSNMP transport options:
Note that individual LBM options can be specified as <scope>|<option>=value, where
  <scope> is one of context, source, receiver, wildcard_receiver, or event_queue
  <option> is the LBM configuration option name
The vertical bar (pipe symbol) is required when specifying individual LBM options.
  config=FILE           use LBM configuration file FILE
  topic=TOPIC           receive statistics on topic TOPIC
                        default is /29west/statistics
  wctopic=PATTERN       receive statistics on wildcard topic PATTERN
                        See  https://communities.informatica.com/infakb/faq/5/Pages/80075.aspx
                        for guidelines on using wildcard topics. Also make sure the statistics
                        topic namespace is disjoint from the data topic namespace.
```

```
UDP transport options:
  port=NUM              receive on UDP port NUM
                        default is 2933
  interface=IP          receive multicast on interface IP
                        default is INADDR_ANY (0.0.0.0)
  mcgroup=GRP           receive on multicast group GRP
```

```
CSV format options:
  separator=CHAR        separate CSV fields with character CHAR
                        defaults to ','
                        Don't use a semicolon!
  passthrough=VAL       VAL may be 'off', 'on' or 'convert'
                        defaults to 'off'
```

```
PB format options:
  passthrough=VAL       VAL may be 'off', 'on' or 'convert'
                        defaults to 'off'
```

1.7.15 Example lbmmrcv.c

Source code: lbmmrcv.c

```
Purpose: application that receives messages from a set of one or more topics.
Usage: lbmmrcv [options]
  -B, --bufsize=#         Set receive socket buffer size to # (in MB)
  -c, --config=FILE       Use LBM configuration file FILE.
                          Multiple config files are allowed.
                          Example:  '-c file1.cfg -c file2.cfg'
  -C, --contexts=NUM      use NUM lbm_context_t objects
  -E, --exit              exit and end upon receiving End-of-Stream notification
  -e, --end-flag=FILE     clean up and exit when file FILE is created
  -h, --help              display this help and exit
  -i, --initial-topic=NUM use NUM as initial topic number
  -o, --regid-offset=offset  use offset to calculate Registration ID
                            (as source registration ID + offset)
                             offset of 0 forces creation of regid by store
  -L, --linger=NUM        linger for NUM seconds after done
  -r, --root=STRING       use topic names with root of STRING
  -R, --receivers=NUM     create NUM receivers
  -s, --statistics        print statistics along with bandwidth
  -v, --verbose           be verbose
  -V, --verify            verify message contents

Monitoring options:
  --monitor-rcv=NUM             monitor receiver every NUM seconds
  --monitor-ctx=NUM             monitor context every NUM seconds
  --monitor-transport=TRANS     use monitor transport module TRANS
                                TRANS may be 'lbm', 'lbmsnmp', or 'udp', default is 'lbm'
  --monitor-transport-opts=OPTS use OPTS as transport module options
  --monitor-format=FMT          use monitor format module FMT
                                FMT may be 'csv' or 'pb'
  --monitor-format-opts=OPTS    use OPTS as format module options
  --monitor-appid=ID            use ID as application ID string


Transport and format options are passed as name=value pairs, separated by a semicolon.
The entire option string should be enclosed in double-quotes.


LBM transport options:
Note that individual LBM options can be specified as <scope>|<option>=value, where
  <scope> is one of context, source, receiver, wildcard_receiver, or event_queue
  <option> is the LBM configuration option name
The vertical bar (pipe symbol) is required when specifying individual LBM options.
  config=FILE            use LBM configuration file FILE
  topic=TOPIC            send statistics on topic TOPIC
                         default is /29west/statistics
  allow_debug=VAL        VAL may be 'off' or 'on'
                         defaults to 'off'


LBMSNMP transport options:
Note that individual LBM options can be specified as <scope>|<option>=value, where
  <scope> is one of context, source, receiver, wildcard_receiver, or event_queue
  <option> is the LBM configuration option name
The vertical bar (pipe symbol) is required when specifying individual LBM options.
  config=FILE            use LBM configuration file FILE
  topic=TOPIC            send statistics on topic TOPIC
                         default is /29west/statistics


UDP transport options:
  address=IP             send statistics to address IP
  port=NUM               send to UDP port NUM
                         default is 2933
  mcgroup=GRP            send on multicast group GRP
  bcaddress=IP           send statistics to broadcast address IP
  ttl=NUM                send multicast statistics with TTL NUM
                         default is 16
```

```
CSV format options:
  separator=CHAR          separate CSV fields with character CHAR
                          defaults to ','
                          Don't use a semicolon!


PB format options:
  filters=FILE            use FILE that contains filter options
```

1.7.16   Example lbmmrcvq.c

Source code: lbmmrcvq.c

```
Purpose: application that receives messages from a set of one or more topics
    using event queues.
Usage: lbmmrcvq [options]
  -B, --bufsize=#         Set receive socket buffer size to # (in MB)
  -c, --config=FILE       Use LBM configuration file FILE.
                          Multiple config files are allowed.
                          Example:  '-c file1.cfg -c file2.cfg'
  -C, --contexts=NUM      use NUM lbm_context_t objects
  -h, --help              display this help and exit
  -i, --initial-topic=NUM use NUM as initial topic number
  -L, --linger=NUM        linger for NUM seconds after done
  -r, --root=STRING       use topic names with root of STRING
  -R, --receivers=NUM     create NUM receivers
  -s, --statistics        print statistics along with bandwidth
  -v, --verbose           be verbose


Monitoring options:
  --monitor-rcv=NUM           monitor receiver every NUM seconds
  --monitor-ctx=NUM           monitor context every NUM seconds
  --monitor-transport=TRANS   use monitor transport module TRANS
                              TRANS may be 'lbm', 'lbmsnmp', or 'udp', default is 'lbm'
  --monitor-transport-opts=OPTS  use OPTS as transport module options
  --monitor-format=FMT        use monitor format module FMT
                              FMT may be 'csv' or 'pb'
  --monitor-format-opts=OPTS  use OPTS as format module options
  --monitor-appid=ID          use ID as application ID string
  --monitor-evq=NUM           monitor event queue every NUM seconds


Transport and format options are passed as name=value pairs, separated by a semicolon.
The entire option string should be enclosed in double-quotes.


LBM transport options:
Note that individual LBM options can be specified as <scope>|<option>=value, where
  <scope> is one of context, source, receiver, wildcard_receiver, or event_queue
  <option> is the LBM configuration option name
The vertical bar (pipe symbol) is required when specifying individual LBM options.
  config=FILE             use LBM configuration file FILE
  topic=TOPIC             send statistics on topic TOPIC
                          default is /29west/statistics
  allow_debug=VAL         VAL may be 'off' or 'on'
                          defaults to 'off'


LBMSNMP transport options:
Note that individual LBM options can be specified as <scope>|<option>=value, where
  <scope> is one of context, source, receiver, wildcard_receiver, or event_queue
```

```
  <option> is the LBM configuration option name
The vertical bar (pipe symbol) is required when specifying individual LBM options.
  config=FILE            use LBM configuration file FILE
  topic=TOPIC            send statistics on topic TOPIC
                         default is /29west/statistics


UDP transport options:
  address=IP             send statistics to address IP
  port=NUM               send to UDP port NUM
                         default is 2933
  mcgroup=GRP            send on multicast group GRP
  bcaddress=IP           send statistics to broadcast address IP
  ttl=NUM                send multicast statistics with TTL NUM
                         default is 16


CSV format options:
  separator=CHAR         separate CSV fields with character CHAR
                         defaults to ','
                         Don't use a semicolon!


PB format options:
  filters=FILE           use FILE that contains filter options
```

1.7.17   Example lbmmreq.c

Source code: lbmmreq.c

```
Purpose: application that sends request messages to a single topic
    and processes responses.
Usage: lbmmreq [options] topic
Available options:
  -c filename = Use LBM configuration file filename.
                Multiple config files are allowed.
                Example:  '-c file1.cfg -c file2.cfg topicname'
  -d delay = delay sending for delay seconds after source creation
  -h = help
  -l len = send messages of len bytes
  -r rate/pct = send with LBT-RM at rate and retransmission pct%
  -R requests = send requests number of requests
  -v = be verbose (-v -v = be even more verbose)
```

1.7.18   Example lbmmsrc.c

Source code: lbmmsrc.c

```
Purpose: send messages on multiple topics, optionally by multiple threads.
    Topic names generated as a root, a dot, and by an integer.
    By default, the first topic created will be '29west.example.multi.0'
Usage: lbmmsrc [options]
Available options:
  -b, --batch=NUM           send messages in batch sizes of NUM between each pause
  -c, --config=FILE         Use LBM configuration file FILE.
                            Multiple config files are allowed.
```

```
                              Example:  '-c file1.cfg -c file2.cfg'
  -d, --delay=NUM             delay sending for delay seconds after source creation
  -h, --help                  display this help and exit
  -i, --initial-topic=NUM     use NUM as initial topic number [0]
  -j, --late-join=NUM         enable Late Join with specified retention buffer size (in bytes)
  -l, --length=NUM            send messages of length NUM bytes
  -L, --linger=NUM            linger for NUM seconds after done
  -M, --messages=NUM          send maximum of NUM messages
  -P, --pause=NUM             pause NUM milliseconds after each send
  -r, --root=STRING           use topic names with root of STRING [29west.example.multi]
  -R, --rate=[UM]DATA/RETR    Set transport type to LBT-R[UM], set data rate limit to
                              DATA bits per second, and set retransmit rate limit to
                              RETR bits per second.  For both limits, the optional
                              k, m, and g suffixes may be used.  For example,
                              '-R 1m/500k' is the same as '-R 1000000/500000'
  -s, --statistics=NUM        print stats every NUM seconds
  -S, --sources=NUM           use NUM sources
  -T, --threads=NUM           use NUM threads
  -v, --verbose               be verbose
  -V, --verifiable_msg        construct verifiable messages

Monitoring options:
  --monitor-src=NUM               monitor source every NUM seconds
  --monitor-ctx=NUM               monitor context every NUM seconds
  --monitor-transport=TRANS       use monitor transport module TRANS
                                  TRANS may be 'lbm', 'lbmsnmp', or 'udp', default is 'lbm'
  --monitor-transport-opts=OPTS   use OPTS as transport module options
  --monitor-format=FMT            use monitor format module FMT
                                  FMT may be 'csv' or 'pb'
  --monitor-format-opts=OPTS      use OPTS as format module options
  --monitor-appid=ID              use ID as application ID string


Transport and format options are passed as name=value pairs, separated by a semicolon.
The entire option string should be enclosed in double-quotes.


LBM transport options:
Note that individual LBM options can be specified as <scope>|<option>=value, where
  <scope> is one of context, source, receiver, wildcard_receiver, or event_queue
  <option> is the LBM configuration option name
The vertical bar (pipe symbol) is required when specifying individual LBM options.
  config=FILE          use LBM configuration file FILE
  topic=TOPIC          send statistics on topic TOPIC
                       default is /29west/statistics
  allow_debug=VAL      VAL may be 'off' or 'on'
                       defaults to 'off'


LBMSNMP transport options:
Note that individual LBM options can be specified as <scope>|<option>=value, where
  <scope> is one of context, source, receiver, wildcard_receiver, or event_queue
  <option> is the LBM configuration option name
The vertical bar (pipe symbol) is required when specifying individual LBM options.
  config=FILE          use LBM configuration file FILE
  topic=TOPIC          send statistics on topic TOPIC
                       default is /29west/statistics


UDP transport options:
  address=IP           send statistics to address IP
  port=NUM             send to UDP port NUM
                       default is 2933
  mcgroup=GRP          send on multicast group GRP
  bcaddress=IP         send statistics to broadcast address IP
  ttl=NUM              send multicast statistics with TTL NUM
                       default is 16
```

```
CSV format options:
  separator=CHAR          separate CSV fields with character CHAR
                          defaults to ','
                          Don't use a semicolon!


PB format options:
  filters=FILE            use FILE that contains filter options
```

1.7.19 Example lbmpong.c

Source code: lbmpong.c

```
Purpose: application that measures round trip message latency.
Usage: lbmpong [-ChIqRv] [-c filename] [-i msgs] [-l len] [-M msgs] [-P msec] [-r rate/pct] [-s se
        -c filename = Use LBM configuration file filename.
                      Multiple config files are allowed.
                      Example:  '-c file1.cfg -c file2.cfg'
        -C = collect RTT data
        -h = help
        -i msgs = send and ignore msgs messages to warm up
        -o offset = use offset to calculate Registration ID
                    (as source registration ID + offset)
                    offset of 0 forces creation of regid by store
        -I = Use MIM
        -l len = use len length messages
        -M msgs = stop after receiving msgs messages
        -P msec = pause after each send msec milliseconds
        -q = use an LBM event queue
        -r [UM]DATA/RETR = Set transport type to LBT-R[UM], set data rate limit to
                           DATA bits per second, and set retransmit rate limit to
                           RETR bits per second.  For both limits, the optional
                           k, m, and g suffixes may be used.  For example,
                           '-r 1m/500k' is the same as '-r 1000000/500000'
        -R = perform RTT measurement per message
        -s seed = init randomization of contents of message payload
        -t secs = run for secs seconds
        -T topic = topic name prefix (appended with '/' and id) [lbmpong]
        -v = be verbose about each message
        id = either 'ping' or 'pong'
```

1.7.20 Example lbmprice.c

Source code: lbmprice.c

```
Purpose: simulated price source and receiver for demonstration.
Usage: lbmprice -s [-h] [-c filename]
        -c filename = Use LBM configuration file filename.
                      Multiple config files are allowed.
                      Example:  '-c file1.cfg -c file2.cfg'
        -h = help
        -H = act has Hot Failover relay for a price source
        -l pct = induce random receiver loss of pct percent
        -n ms = set receiver NAK generation interval to ms milliseconds
```

```
      -s = act as a price source (acts as a receiver by default)
      -t ttl = set resolver (and multicast source) ttl to ttl
      -v = be verbose


Alternate usage: lbmprice [-h] [-c filename]
      -c filename = read config file
      -h = help
      -H = use Hot Failover receiver
      -l pct = induce random receiver loss of pct percent, print max latency
      -n ms = set receiver NAK generation interval to ms milliseconds
      -o mode = set ordered delivery mode (1=ordered, 0=arrival order)
      -t ttl = set resolver (and multicast source) ttl to ttl
      -v = be verbose
```

1.7.21 Example lbmrcv.c

Source code: lbmrcv.c

```
Purpose: application that receives messages from a given topic.
Usage: lbmrcv [-ACEfhqsSvV] [-c filename] [-r msgs] [-U losslev] topic
Available options:
  -A, --ascii         display messages as ASCII text (-A -A = newlines after each msg)
  -c, --config=FILE   Use LBM configuration file FILE.
                      Multiple config files are allowed.
                      Example:  '-c file1.cfg -c file2.cfg'
  -C, --context-stats  fetch context rather than receiver stats
  -E, --exit          exit when source stops sending
  -f, --failover      use a hot-failover receiver
  -h, --help          display this help and exit
  -q, --eventq        use an LBM event queue
  -r, --msgs=NUM      exit after NUM messages
  -O, --orderchecks    Enable message order checking
  -N, --channel=NUM   subscribe to channel NUM
  -s, --stats=NUM     print LBM statistics every NUM seconds
  --max-sources=NUM   allow up to NUM sources (for statistics gathering purposes)
  -S, --stop          exit when source stops sending, and print throughput summary
  -U, --losslev=NUM   exit after NUM% unrecoverable loss
  -v, --verbose       be verbose about incoming messages (-v -v = be even more verbose)
  -V, --verify        verify message contents


Monitoring options:
  --monitor-rcv=NUM              monitor receiver every NUM seconds
  --monitor-ctx=NUM              monitor context every NUM seconds
  --monitor-transport=TRANS      use monitor transport module TRANS
                                 TRANS may be 'lbm', 'lbmsnmp', or 'udp', default is 'lbm'
  --monitor-transport-opts=OPTS  use OPTS as transport module options
  --monitor-format=FMT           use monitor format module FMT
                                 FMT may be 'csv' or 'pb'
  --monitor-format-opts=OPTS     use OPTS as format module options
  --monitor-appid=ID             use ID as application ID string


Transport and format options are passed as name=value pairs, separated by a semicolon.
The entire option string should be enclosed in double-quotes.


LBM transport options:
Note that individual LBM options can be specified as <scope>|<option>=value, where
  <scope> is one of context, source, receiver, wildcard_receiver, or event_queue
```

```
  <option> is the LBM configuration option name
The vertical bar (pipe symbol) is required when specifying individual LBM options.
  config=FILE            use LBM configuration file FILE
  topic=TOPIC            send statistics on topic TOPIC
                         default is /29west/statistics
  allow_debug=VAL        VAL may be 'off' or 'on'
                         defaults to 'off'


LBMSNMP transport options:
Note that individual LBM options can be specified as <scope>|<option>=value, where
  <scope> is one of context, source, receiver, wildcard_receiver, or event_queue
  <option> is the LBM configuration option name
The vertical bar (pipe symbol) is required when specifying individual LBM options.
  config=FILE            use LBM configuration file FILE
  topic=TOPIC            send statistics on topic TOPIC
                         default is /29west/statistics


UDP transport options:
  address=IP             send statistics to address IP
  port=NUM               send to UDP port NUM
                         default is 2933
  mcgroup=GRP            send on multicast group GRP
  bcaddress=IP           send statistics to broadcast address IP
  ttl=NUM                send multicast statistics with TTL NUM
                         default is 16


CSV format options:
  separator=CHAR         separate CSV fields with character CHAR
                         defaults to ','
                         Don't use a semicolon!


PB format options:
  filters=FILE           use FILE that contains filter options
```

1.7.22   Example lbmrcvq.c

Source code: lbmrcvq.c

```
Purpose: application that receives messages from a given topic using an event
    queue.
Usage: lbmrcvq [options] topic
Available options:
  -c, --config=FILE     Use LBM configuration file FILE.
  -C, --context-stats   fetch context rather than receiver stats
                        Multiple config files are allowed.
                        Example:  '-c file1.cfg -c file2.cfg'
  -E, --exit            exit after source ends
  -h, --help            display this help and exit
  -r NUM                delete receiver after NUM messages
  -s, --stats=NUM       print LBM statistics every NUM seconds
  -S, --stop            exit after source ends, print throughput summary
  -v, --verbose         be verbose about incoming messages (-v -v = be even more verbose)
  -V, --verify          verify message contents


Monitoring options:
  --monitor-rcv=NUM             monitor receiver every NUM seconds
  --monitor-ctx=NUM             monitor context every NUM seconds
```

```
  --monitor-transport=TRANS     use monitor transport module TRANS
                                TRANS may be 'lbm', 'lbmsnmp', or 'udp', default is 'lbm'
  --monitor-transport-opts=OPTS use OPTS as transport module options
  --monitor-format=FMT          use monitor format module FMT
                                FMT may be 'csv' or 'pb'
  --monitor-format-opts=OPTS    use OPTS as format module options
  --monitor-appid=ID            use ID as application ID string
  --monitor-evq=NUM             monitor event queue every NUM seconds


Transport and format options are passed as name=value pairs, separated by a semicolon.
The entire option string should be enclosed in double-quotes.


LBM transport options:
Note that individual LBM options can be specified as <scope>|<option>=value, where
  <scope> is one of context, source, receiver, wildcard_receiver, or event_queue
  <option> is the LBM configuration option name
The vertical bar (pipe symbol) is required when specifying individual LBM options.
  config=FILE          use LBM configuration file FILE
  topic=TOPIC          send statistics on topic TOPIC
                       default is /29west/statistics
  allow_debug=VAL      VAL may be 'off' or 'on'
                       defaults to 'off'


LBMSNMP transport options:
Note that individual LBM options can be specified as <scope>|<option>=value, where
  <scope> is one of context, source, receiver, wildcard_receiver, or event_queue
  <option> is the LBM configuration option name
The vertical bar (pipe symbol) is required when specifying individual LBM options.
  config=FILE          use LBM configuration file FILE
  topic=TOPIC          send statistics on topic TOPIC
                       default is /29west/statistics


UDP transport options:
  address=IP           send statistics to address IP
  port=NUM             send to UDP port NUM
                       default is 2933
  mcgroup=GRP          send on multicast group GRP
  bcaddress=IP         send statistics to broadcast address IP
  ttl=NUM              send multicast statistics with TTL NUM
                       default is 16


CSV format options:
  separator=CHAR       separate CSV fields with character CHAR
                       defaults to ','
                       Don't use a semicolon!


PB format options:
  filters=FILE         use FILE that contains filter options
```

1.7.23 Example lbmrcvxsp.c

Source code: lbmrcvxsp.c

```
Purpose: application that receives messages from a given topic, mapping transports to various XSPs
Usage: lbmrcv [-ACdDEhPrRsSv] [-c filename] [-r msgs] topic
Available options:
```

```
 -A, --ascii                    display messages as ASCII text (-A -A = newlines after each msg)
 -c, --config=FILE              Use LBM configuration file FILE.
                                Multiple config files are allowed.
                                Example:  '-c file1.cfg -c file2.cfg'
 -C, --context-stats            fetch context rather than receiver stats
 -d, --defer-xsp-deletion       don't delete xsps until shutdown
 -D, --default-xsp              use the default XSP for all transports
 -E, --exit                     exit when source stops sending
 -h, --help                     display this help and exit
 -P, --round-robin-preallocate  preallocate the XSPs - use with -R
 -Q, --sequential-xsps          use sequential mode for XSPs
 -r, --msgs=NUM                 exit after NUM messages
 -R, --round-robin=NUM          use a simple round-robin method for assigning transports to NUM
                                (this is the DEFAULT for this application, with a NUM of 3
 -s, --stats=NUM                print LBM statistics every NUM seconds
 -S, --stop                     exit when source stops sending, and print throughput summary
 -v, --verbose                  be verbose about incoming messages (-v -v = be even more verbose
 -V, --verify                   verify message contents
```

1.7.24 Example lbmreq.c

Source code: lbmreq.c

```
Purpose: application that sends requests on a single topic and waits for
    responses.
Usage: lbmreq [options] topic
Available options:
  -c filename = Use LBM configuration file filename.
               Multiple config files are allowed.
               Example:  '-c file1.cfg -c file2.cfg'
  -d sec = delay sending for delay seconds after source creation
  -h = help
  -l len = send messages of len bytes
  -L linger = linger for linger seconds before closing context
  -P sec = pause sec seconds after sending request for responses to arrive
  -r [UM]DATA/RETR = Set transport type to LBT-R[UM], set data rate limit to
                    DATA bits per second, and set retransmit rate limit to
                    RETR bits per second.  For both limits, the optional
                    k, m, and g suffixes may be used.  For example,
                    '-r 1m/500k' is the same as '-r 1000000/500000'
  -R requests = send requests number of requests
  -q = Use Event Queue
  -v = be verbose (-v -v = be even more verbose)
```

1.7.25 Example lbmresp.c

Source code: lbmresp.c

```
Purpose: application that receives request messages on a single topic and
    and sends responses back
Usage: lbmresp [-Ehsv] [-c filename] [-l len] [-r responses] [-f topic] topic
       -c filename = Use LBM configuration file filename.
                    Multiple config files are allowed.
                    Example:  '-c file1.cfg -c file2.cfg'
```

```
-E = end after end-of-stream
-h = help
-l len = use len bytes for the length of each response
-r responses = send responses messages for each request
-s = be silent about incoming messages
-v = be verbose (-v -v = be even more verbose)
-f = forward request to responders listening on given topic
```

1.7.26 Example lbmresping.c

Source code: lbmresping.c

```
Purpose: Application that tests the operation of lbm topic resolution by creating
    a source and reporting time required for it to resolve and join the
    source.
Usage: lbmresping [-h] [-c filename] [unicast_resolver_host]
       -c filename = Use LBM configuration file filename.
                     Multiple config files are allowed.
                     Example:  '-c file1.cfg -c file2.cfg'
       -h = help
```

1.7.27 Example lbmrespq.c

Source code: lbmrespq.c

```
Purpose: application that receives request messages on a single topic and
    and sends responses back, using an event queue.
Usage: lbmrespq [-hs] [-c filename] [-r msgs] topic
       -c filename = Use LBM configuration file filename.
                     Multiple config files are allowed.
                     Example:  '-c file1.cfg -c file2.cfg'
       -h = help
       -P msecs = pause msecs milliseconds before sending response
       -r msgs = delete receiver after msgs request messages
       -s = be silent about requests/sec rate
       -v = be verbose (-v -v = be even more verbose)
```

1.7.28 Example lbmspike.c

Source code: lbmspike.c

```
Purpose: application that generates & receives message spikes for
    performance testing.
Usage: lbmspike -R [-dhq] [-c filename] [-o ord] [-u bufsiz] [topic]
       -c filename = Use LBM configuration file filename.
                     Multiple config files are allowed.
                     Example:  '-c file1.cfg -c file2.cfg'
       -d = dump message time stamps to a file
       -h = help
```

```
        -o ord = set receiver ordered delivery to ord
        -q = processess received messages on an event queue
        -R = role is receiver (default role is source)
        -u bufsiz = UDP buffer size for LBT-RM


Alternate usage: lbmspike [-dhLn] [-B bghumms] [-c filename] [-l len] [-M msgs] [-r rate/pct] [-v
        -B bghumms = milliseconds between "background hum" messages
        -c filename = read config file filename
        -d = dump message time stamps to a file
        -h = help
        -l len = use len length messages
        -L = use TCP-LB
        -M msgs = stop after receiving msgs messages
        -n = use non-blocking writes
        -r [UM]DATA/RETR = Set transport type to LBT-R[UM], set data rate limit to
                           DATA bits per second, and set retransmit rate limit to
                           RETR bits per second.  For both limits, the optional
                           k, m, and g suffixes may be used.  For example,
                           '-r 1m/500k' is the same as '-r 1000000/500000'
        -v recovms = milliseconds after spike to allow for recovery
```

1.7.29 Example lbmsrc.c

Source code: lbmsrc.c

```
Purpose: application that sends to a single topic as fast possible.
Usage: lbmsrc [options] topic
Available options:
  -c, --config=FILE         Use LBM configuration file FILE.
                            Multiple config files are allowed.
                            Example:  '-c file1.cfg -c file2.cfg'
  -d, --delay=NUM           delay sending for NUM seconds after source creation
  -h, --help                display this help and exit
  -j, --late-join=NUM       enable Late Join with specified retention buffer size (in bytes)
  -l, --length=NUM          send messages of NUM bytes
  -L, --linger=NUM          linger for NUM seconds before closing context
  -M, --messages=NUM        send NUM messages
  -n, --non-block           use non-blocking I/O
  -N, --channel=NUM         send on channel NUM
  -P, --pause=NUM           pause NUM milliseconds after each send
  -R, --rate=[UM]DATA/RETR  Set transport type to LBT-R[UM], set data rate limit to
                            DATA bits per second, and set retransmit rate limit to
                            RETR bits per second.  For both limits, the optional
                            k, m, and g suffixes may be used.  For example,
                            '-R 1m/500k' is the same as '-R 1000000/500000'
  -s, --statistics=NUM      print statistics every NUM seconds
  -v, --verbose             be verbose about each message
  -V, --verifiable          construct verifiable messages


Monitoring options:
  --monitor-src=NUM             monitor source every NUM seconds
  --monitor-ctx=NUM             monitor context every NUM seconds
  --monitor-transport=TRANS     use monitor transport module TRANS
                                TRANS may be 'lbm', 'lbmsnmp', or 'udp', default is 'lbm'
  --monitor-transport-opts=OPTS use OPTS as transport module options
  --monitor-format=FMT          use monitor format module FMT
                                FMT may be 'csv' or 'pb'
  --monitor-format-opts=OPTS    use OPTS as format module options
  --monitor-appid=ID            use ID as application ID string
```

```
Transport and format options are passed as name=value pairs, separated by a semicolon.
The entire option string should be enclosed in double-quotes.


LBM transport options:
Note that individual LBM options can be specified as <scope>|<option>=value, where
  <scope> is one of context, source, receiver, wildcard_receiver, or event_queue
  <option> is the LBM configuration option name
The vertical bar (pipe symbol) is required when specifying individual LBM options.
  config=FILE            use LBM configuration file FILE
  topic=TOPIC           send statistics on topic TOPIC
                        default is /29west/statistics
  allow_debug=VAL       VAL may be 'off' or 'on'
                        defaults to 'off'


LBMSNMP transport options:
Note that individual LBM options can be specified as <scope>|<option>=value, where
  <scope> is one of context, source, receiver, wildcard_receiver, or event_queue
  <option> is the LBM configuration option name
The vertical bar (pipe symbol) is required when specifying individual LBM options.
  config=FILE            use LBM configuration file FILE
  topic=TOPIC           send statistics on topic TOPIC
                        default is /29west/statistics


UDP transport options:
  address=IP            send statistics to address IP
  port=NUM              send to UDP port NUM
                        default is 2933
  mcgroup=GRP           send on multicast group GRP
  bcaddress=IP          send statistics to broadcast address IP
  ttl=NUM               send multicast statistics with TTL NUM
                        default is 16


CSV format options:
  separator=CHAR        separate CSV fields with character CHAR
                        defaults to ','
                        Don't use a semicolon!


PB format options:
  filters=FILE          use FILE that contains filter options
```

1.7.30 Example lbmssrc.c

Source code: lbmssrc.c

```
Purpose: application that uses Smart Source to send to a single topic.
Usage: lbmssrc [options] topic
Available options:
  -a, --available-data-space  print the length of available data space
  -b, --user-supplied-buffer  send messages using a user-supplied buffer
  -c, --config=FILE           Use LBM configuration file FILE.
                              Multiple config files are allowed.
                              Example: '-c file1.cfg -c file2.cfg'
  -d, --delay=NUM             delay sending for NUM seconds after source creation
  -h, --help                  display this help and exit
  -i, --int-mprop=VAL,KEY     send integer message property value VAL with name KEY
  -j, --late-join=NUM         enable Late Join with specified retention buffer count
  -l, --length=NUM            send messages of NUM bytes
```

```
  -L, --linger=NUM            linger for NUM seconds before closing context
  -M, --messages=NUM          send NUM messages
  -N, --channel=NUM           send on channel NUM
  -S, --perf-stats=NUM,OT     print performance stats every NUM messages sent
                              If optional OT is given, override the default 10 usec Outlier Thresh
  -P, --pause=NUM             pause NUM milliseconds after each send
  -s, --statistics=NUM        print statistics every NUM seconds
  -v, --verbose               be verbose; add per message data
  -V, --verifiable            construct verifiable messages

Monitoring options:
  --monitor-src=NUM               monitor source every NUM seconds
  --monitor-ctx=NUM               monitor context every NUM seconds
  --monitor-transport=TRANS       use monitor transport module TRANS
                                  TRANS may be 'lbm', 'lbmsnmp', or 'udp', default is 'lbm'
  --monitor-transport-opts=OPTS   use OPTS as transport module options
  --monitor-format=FMT            use monitor format module FMT
                                  FMT may be 'csv' or 'pb'
  --monitor-format-opts=OPTS      use OPTS as format module options
  --monitor-appid=ID              use ID as application ID string


Transport and format options are passed as name=value pairs, separated by a semicolon.
The entire option string should be enclosed in double-quotes.


LBM transport options:
Note that individual LBM options can be specified as <scope>|<option>=value, where
  <scope> is one of context, source, receiver, wildcard_receiver, or event_queue
  <option> is the LBM configuration option name
The vertical bar (pipe symbol) is required when specifying individual LBM options.
  config=FILE          use LBM configuration file FILE
  topic=TOPIC          send statistics on topic TOPIC
                       default is /29west/statistics
  allow_debug=VAL      VAL may be 'off' or 'on'
                       defaults to 'off'


LBMSNMP transport options:
Note that individual LBM options can be specified as <scope>|<option>=value, where
  <scope> is one of context, source, receiver, wildcard_receiver, or event_queue
  <option> is the LBM configuration option name
The vertical bar (pipe symbol) is required when specifying individual LBM options.
  config=FILE          use LBM configuration file FILE
  topic=TOPIC          send statistics on topic TOPIC
                       default is /29west/statistics


UDP transport options:
  address=IP           send statistics to address IP
  port=NUM             send to UDP port NUM
                       default is 2933
  mcgroup=GRP          send on multicast group GRP
  bcaddress=IP         send statistics to broadcast address IP
  ttl=NUM              send multicast statistics with TTL NUM
                       default is 16


CSV format options:
  separator=CHAR       separate CSV fields with character CHAR
                       defaults to ','
                       Don't use a semicolon!


PB format options:
  filters=FILE         use FILE that contains filter options
```

1.7.31 Example lbmssrcreq.c

Source code: lbmssrcreq.c

```
Purpose: application that sends requests on a single topic and waits for
    responses.
Usage: lbmssrcreq [options] topic
Available options:
  -a, --available-data-space  print the length of available data space
  -b, --user-supplied-buffer  send messages using a user-supplied buffer
  -c filename = Use LBM configuration file filename.
                Multiple config files are allowed.
                Example:  '-c file1.cfg -c file2.cfg'
  -d sec = delay sending for delay seconds after source creation
  -h = help
  -l len = send messages of len bytes
  -L linger = linger for linger seconds before closing context
  -P sec = pause sec seconds after sending request for responses to arrive
  -r [UM]DATA/RETR = Set transport type to LBT-R[UM], set data rate limit to
                     DATA bits per second, and set retransmit rate limit to
                     RETR bits per second.  For both limits, the optional
                     k, m, and g suffixes may be used.  For example,
                     '-r 1m/500k' is the same as '-r 1000000/500000'
  -R requests = send requests number of requests
  -v = be verbose (-v -v = be even more verbose)
```

1.7.32 Example lbmstrm.c

Source code: lbmstrm.c

```
Purpose: application that sends messages to one or more topics at a
    specified rate.
Usage: lbmstrm [options]
  Topic names generated as a root, followed by a dot, followed by an integer.
  By default, the first topic created will be '29west.example.multi.0'
Available options:
  -c, --config=FILE       Use LBM configuration file FILE.
                          Multiple config files are allowed.
                          Example:  '-c file1.cfg -c file2.cfg'
  -h, --help              display this help and exit
  -H, --hf                Use hot failover sources
  -i, --initial-topic=NUM use NUM as initial topic number [0]
  -j, --late-join=NUM     enable Late Join with specified retention buffer size (in bytes)
  -l, --length=NUM        send messages of length NUM bytes [25]
  -L, --linger=NUM        linger for NUM seconds after done [10]
  -m, --message-rate=NUM  send at NUM messages per second [10000]
  -M, --messages=NUM      send maximum of NUM messages [10000000]
  -r, --root=STRING       use topic names with root of STRING [29west.example.multi]
  -R, --rate=[UM]DATA/RETR  Set transport type to LBT-R[UM], set data rate limit to
                          DATA bits per second, and set retransmit rate limit to
                          RETR bits per second.  For both limits, the optional
                          k, m, and g suffixes may be used.  For example,
                          '-R 1m/500k' is the same as '-R 1000000/500000'
  -s, --statistics=NUM    print stats every NUM seconds
  -S, --sources=NUM       use NUM sources [100]
  -t, --tight             tight loop (cpu-bound) for even message spacing
  -T, --threads=NUM       use NUM threads [1]
  -x, --bits=NUM          use NUM bits for hot failover sequence number size (32 or 64)
```

1.7.33 Example lbmtrreq.c

Source code: lbmtrreq.c

```
Purpose: application that invokes the Topic Resolution Request API.
Usage: lbmtrreq [options]
Available options:
  -c, --config=FILE     Use LBM configuration file FILE.
                        Multiple config files are allowed.
                        Example:  '-c file1.cfg -c file2.cfg'
  -a, --adverts         Request Advertisements
  -q, --queries         Request Queries
  -w, --wildcard        Request Wildcard Queries
  -A, --ctx-ads         Request Context Advertisements
  -Q, --ctx-queries     Request Context Queries
  -I, --gw-interest     Request Gateway Interest
  -i, --interval=NUM    Interval between request
  -d, --duration=NUM    Minimum duration of requests
  -L, --linger=NUM      Linger for NUM seconds before closing context
```

1.7.34 Example lbmwrcv.c

Source code: lbmwrcv.c

```
Purpose: application that receives messages from a wildcard receiver.
Usage: lbmwrcv [options] pattern
Available options:
  -c, --config=FILE     Use LBM configuration file FILE.
                        Multiple config files are allowed.
                        Example:  '-c file1.cfg -c file2.cfg'
  -D, --deregister      Send Deregistration after receiving 1000 messages
  -E, --exit            exit after source ends
  -h, --help            display this help and exit
  -q                    Use event queue
  -r NUM                delete receiver after NUM messages
  -N, --channel=NUM     subscribe to channel NUM
  -s, --statistics      print statistics along with bandwidth
  -v, --verbose         be verbose about incoming messages (-v -v = be even more verbose)


Monitoring options:
  --monitor-ctx=NUM             monitor context every NUM seconds
  --monitor-transport=TRANS     use monitor transport module TRANS
                                TRANS may be 'lbm', 'lbmsnmp', or 'udp', default is 'lbm'
  --monitor-transport-opts=OPTS use OPTS as transport module options
  --monitor-format=FMT          use monitor format module FMT
                                FMT may be 'csv' or 'pb'
  --monitor-format-opts=OPTS    use OPTS as format module options
  --monitor-appid=ID            use ID as application ID string


Transport and format options are passed as name=value pairs, separated by a semicolon.
The entire option string should be enclosed in double-quotes.


LBM transport options:
```

```
Note that individual LBM options can be specified as <scope>|<option>=value, where
  <scope> is one of context, source, receiver, wildcard_receiver, or event_queue
  <option> is the LBM configuration option name
The vertical bar (pipe symbol) is required when specifying individual LBM options.
  config=FILE           use LBM configuration file FILE
  topic=TOPIC           send statistics on topic TOPIC
                        default is /29west/statistics
  allow_debug=VAL       VAL may be 'off' or 'on'
                        defaults to 'off'


LBMSNMP transport options:
Note that individual LBM options can be specified as <scope>|<option>=value, where
  <scope> is one of context, source, receiver, wildcard_receiver, or event_queue
  <option> is the LBM configuration option name
The vertical bar (pipe symbol) is required when specifying individual LBM options.
  config=FILE           use LBM configuration file FILE
  topic=TOPIC           send statistics on topic TOPIC
                        default is /29west/statistics


UDP transport options:
  address=IP            send statistics to address IP
  port=NUM              send to UDP port NUM
                        default is 2933
  mcgroup=GRP           send on multicast group GRP
  bcaddress=IP          send statistics to broadcast address IP
  ttl=NUM               send multicast statistics with TTL NUM
                        default is 16


CSV format options:
  separator=CHAR        separate CSV fields with character CHAR
                        defaults to ','
                        Don't use a semicolon!


PB format options:
  filters=FILE          use FILE that contains filter options
```

1.7.35   Example lbmwrcvq.c

Source code: lbmwrcvq.c

```
Purpose: application that receives messages from a wildcard receiver, using an
    event queue.
Usage: lbmwrcvq [options] pattern
Available options:
  -c, --config=FILE    Use LBM configuration file FILE.
                       Multiple config files are allowed.
                       Example:  '-c file1.cfg -c file2.cfg'
  -E, --exit           exit after source ends
  -h, --help           display this help and exit
  -r NUM               delete receiver after NUM messages
  -s, --statistics     print statistics along with bandwidth
  -v, --verbose        be verbose about incoming messages (-v -v = be even more verbose)


Monitoring options:
  --monitor-ctx=NUM            monitor context every NUM seconds
  --monitor-transport=TRANS    use monitor transport module TRANS
                               TRANS may be 'lbm', 'lbmsnmp', or 'udp', default is 'lbm'
```

```
  --monitor-transport-opts=OPTS  use OPTS as transport module options
  --monitor-format=FMT             use monitor format module FMT
                                   FMT may be 'csv' or 'pb'
  --monitor-format-opts=OPTS       use OPTS as format module options
  --monitor-appid=ID               use ID as application ID string
  --monitor-evq=NUM                monitor event queue every NUM seconds


Transport and format options are passed as name=value pairs, separated by a semicolon.
The entire option string should be enclosed in double-quotes.


LBM transport options:
Note that individual LBM options can be specified as <scope>|<option>=value, where
  <scope> is one of context, source, receiver, wildcard_receiver, or event_queue
  <option> is the LBM configuration option name
The vertical bar (pipe symbol) is required when specifying individual LBM options.
  config=FILE            use LBM configuration file FILE
  topic=TOPIC            send statistics on topic TOPIC
                         default is /29west/statistics
  allow_debug=VAL        VAL may be 'off' or 'on'
                         defaults to 'off'


LBMSNMP transport options:
Note that individual LBM options can be specified as <scope>|<option>=value, where
  <scope> is one of context, source, receiver, wildcard_receiver, or event_queue
  <option> is the LBM configuration option name
The vertical bar (pipe symbol) is required when specifying individual LBM options.
  config=FILE            use LBM configuration file FILE
  topic=TOPIC            send statistics on topic TOPIC
                         default is /29west/statistics


UDP transport options:
  address=IP             send statistics to address IP
  port=NUM               send to UDP port NUM
                         default is 2933
  mcgroup=GRP            send on multicast group GRP
  bcaddress=IP           send statistics to broadcast address IP
  ttl=NUM                send multicast statistics with TTL NUM
                         default is 16


CSV format options:
  separator=CHAR         separate CSV fields with character CHAR
                         defaults to ','
                         Don't use a semicolon!


PB format options:
  filters=FILE           use FILE that contains filter options
```

1.7.36 Example minrcv.c

Source code: minrcv.c

```
minrcv.c: minimal application that receives messages from a given topic.
```

1.7.37 Example minrcv.cpp

Source code: minrcv.cpp

```
 minimal C++ application that receives messages from a given topic.
```

1.7.38 Example minsrc.c

Source code: minsrc.c

```
minsrc.c: minimal application that sends to a given topic.
```

1.7.39 Example srs_cmd.c

Source code: srs_cmd.c

```
Purpose: send unicast immediate command messages to an SRS daemon.
Usage: srs_cmd [options] [command_string]
Available options:
  -c filename = Use LBM configuration file filename.
                Multiple config files are allowed.
                Example:  '-c file1.cfg -c file2.cfg'
  -h = help
  -L linger = linger for linger seconds before closing context
  -T target = target for unicast immediate messages (required)

         help (print this message): h                                      *
           quit (exit application): q                                      *
                report SRS version: version                                *
  set category publishing interval: srs_stats 0 | 200-N                    *
                                    um_client_stats 0 | 200-N              *
                                    connection_events 0 | 200-N            *
                                    srs_error_stats 0 | 200-N              *
                                    um_client_error_stats 0 | 200-N        *
                                    config_opts 0 | 200-N                   *
                                    internal_config_opts 0 | 200-N         *
      set all publishing intervals: interval 0 | 200-N                     *
                 snapshot category: snap srs_stats | um_client_stats |     *
                                    connection_events | srs_error_stats |  *
                                    um_client_error_stats | config_opts |  *
                                    internal_config_opts                   *
          snapshot all categories: snap                                    *
```

1.7.40 Example srs_monitor_info_receiver.c

Source code: srs_monitor_info_receiver.c

```
Purpose: receive SRS monitor info messages on the specified topic.
Usage: srs_monitor_info_receiver [options] topic
Available options:
  -c, --config=FILE    Use LBM configuration file filename.
                       Multiple config files are allowed.
                       Example: '-c file1.cfg -c file2.cfg'
  -E, --exit           exit upon EOS reception
  -h, --help           help
  -L, --linger         linger for linger seconds before closing context
```

1.7.41 Example srs_monitor_info_receiver_json.c

Source code: srs_monitor_info_receiver_json.c

```
Purpose: receive SRS monitor info messages on the specified topic.
Usage: srs_monitor_info_receiver [options] topic
Available options:
  -c, --config=FILE    Use LBM configuration file filename.
                       Multiple config files are allowed.
                       Example: '-c file1.cfg -c file2.cfg'
  -E, --exit           exit upon EOS reception
  -h, --help           help
  -L, --linger         linger for linger seconds before closing context
```

1.7.42 Example tnwgdcmd.c

Source code: tnwgdcmd.c

```
Purpose: application sends unicast immediate command messages to a tnwgd publishing daemon.
Usage: tnwgdcmd -T target_string -c config_file [command_string]
Available options:
  -c filename = Use LBM configuration file filename.
             Multiple config files are allowed.
             Example: '-c file1.cfg -c file2.cfg'
  -h = help
  -L linger = linger for linger seconds before closing context
  -T target = target for unicast immediate messages (mandatory)


  help (print this message): h                                          *
    quit (exit application): q                                          *
    set publishing interval: (0-N = interval in seconds)                *
                             ri 0-N      (routing info)                 *
                             gcfg 0-N    (gateway config)               *
          ["portal name"]    pcfg 0-N    (portal config)                *
          ["portal name"]    pstat 0-N   (portal stats)                 *
                             mallinfo 0-N (malloc info)                 *
                                                                        *
    snapshot all groups (and all portals) : snap                       *
    snapshot single group: snap (ri|gcfg|pcfg|pstat|mallinfo)          *
    snapshot single portal: "portal name" snap pcfg|pstat              *
    Print the current version of the monitor: version                  *
```

1.7.43 Example tnwgdmon.c

Source code: tnwgdmon.c

```
Purpose: application that receives DRO daemon messages on the specified publishing topic.
Usage: tnwgdmon [-Ehv] [-c filename] publishing_topic
Available options:
  -c, --config=FILE    Use LBM configuration file FILE.
                       Multiple config files are allowed.
                       Example:  '-c file1.cfg -c file2.cfg'
  -E, --exit           exit when source stops sending
  -h, --help           display this help and exit
  -v, --verbose        be verbose about incoming messages (-v -v = be even more verbose)
```

1.7.44 Example ume-example-rcv-2.c

Source code: ume-example-rcv-2.c

```
ume-example-rcv-2.c: - Persistent example receiver program.
See Persistence Guide document.
```

1.7.45 Example ume-example-rcv-3.c

Source code: ume-example-rcv-3.c

```
ume-example-rcv-3.c: - Persistent example receiver program.
See Persistence Guide document.
```

1.7.46 Example ume-example-rcv.c

Source code: ume-example-rcv.c

```
ume-example-rcv.c: - Persistent example receiver program.
See Persistence Guide document.
```

1.7.47 Example ume-example-src-2.c

Source code: ume-example-src-2.c

```
ume-example-src-2.c: - Persistent example source program.
See Persistence Guide document.
```

1.7.48   Example ume-example-src-3.c

Source code: ume-example-src-3.c

```
ume-example-src-3.c: - Persistent example source program.
See Persistence Guide document.
```

1.7.49   Example ume-example-src.c

Source code: ume-example-src.c

```
ume-example-src.c: - Persistent example receiver program.
See Persistence Guide document.
```

1.7.50   Example umedcmd.c

Source code: umedcmd.c See **umedcmd Man Page** for usage information.

1.7.51   Example umedmon.c

Source code: umedmon.c

```
Purpose: application that receives umestore daemon messages on the specified publishing topic.
Usage: umedmon [-Ehv] [-c filename] publishing_topic
Available options:
  -c, --config=FILE    Use LBM configuration file FILE.
                       Multiple config files are allowed.
                       Example:  '-c file1.cfg -c file2.cfg'
  -E, --exit           exit when source stops sending
  -h, --help           display this help and exit
  -v, --verbose        be verbose about incoming messages (-v -v = be even more verbose)
```

1.7.52   Example umercv.c

Source code: umercv.c

```
Purpose: application that receives persisted messages from a given topic.
Usage: umercv [options] topic
Available options:
  -A, --ascii              display messages as ASCII text (-A -A for newlines after each msg)
  -c, --config=FILE        Use LBM configuration file FILE.
                           Multiple config files are allowed.
                           Example:  '-c file1.cfg -c file2.cfg'
  -D, --deregister=NUM     Deregister the receiver after receiving NUM messages
  -E, --exit               exit after source ends
  -e, --explicit-ack=N     send an Explicit ACK every N messages
  -h, --help               display this help and exit
  --max-sources=num        allow num sources (for statistics gathering purposes)
  -i, --regid-offset=offset   use offset to calculate Registration ID
                           (as source registration ID + offset)
                           offset of 0 forces creation of regid by store
  -N, --seqnum=X           display recovery sequence number info and set low seqnum to low+X
  -r, --msgs=NUM           delete receiver after NUM messages
      --session-id=NUM     Use NUM as a Session ID rather than using a Registration ID
                           (regid-offset will be ignored)
  -s, --statistics=NUM     print statistics every NUM seconds, along with bandwidth
  -S, --stop               exit after source ends, print throughput summary
  -u, --uregid=num         set User settable Registration ID to num for context
  -v, --verbose            be verbose about incoming messages
                           (-v -v = be even more verbose)
  -V, --verify             verify message contents
  -x, --no-exit-on-reg-error  don't exit on registration error (default is to exit)
```

1.7.53 Example umesnaprepo.c

Source code: umesnaprepo.c See **umesnaprepo Man Page** for usage information.

1.7.54 Example umesrc.c

Source code: umesrc.c

```
Purpose: application that sends persisted messages to a given topic at a
    specified rate.
Usage: umesrc [options] topic
Available options:
  -c, --config=FILE        Use LBM configuration file FILE.
                           Multiple config files are allowed.
                           Example:  '-c file1.cfg -c file2.cfg'
  -d, --delay=NUM          delay sending for NUM seconds after source creation
  -D, --deregister          deregister the source after sending messages
  -h, --help               display this help and exit
  -j, --late-join          turn on UME late join
  -f, --flight-size=NUM    allow NUM unstabilized messages in flight (determines message rate)
  -l, --length=NUM         send messages of NUM bytes
  -L, --linger=NUM         linger for NUM seconds before closing context
  -M, --messages=NUM       send NUM messages
  -m, --message-rate=NUM   send at NUM messages per second if allowed by the flight size setting
  -N, --seqnum-info        display sequence number information from source events
  -n, --non-block          use non-blocking I/O
  -P, --pause=NUM          pause NUM milliseconds after each send
  -R, --rate=[UM]DATA/RETR Set transport type to LBT-R[UM], set data rate limit to
```

```
                                   DATA bits per second, and set retransmit rate limit to
                                   RETR bits per second.  For both limits, the optional
                                   k, m, and g suffixes may be used.  For example,
                                   '-R 1m/500k' is the same as '-R 1000000/500000'
  -s, --statistics=NUM    print statistics every NUM seconds
  -S, --store=IP          use specified UME store
  -t, --storename=NAME    use specified UME store
  -v, --verbose           print additional info in verbose form
  -V, --verifiable        construct verifiable messages
```

1.7.55 Example umessrc.c

Source code: umessrc.c

```
Purpose: application that uses Smart Source sends to a given topic. Understands persistence.
Usage: umessrc [options] topic
Available options:
  -a, --available-data-space  print the length of available data space
  -b, --user-supplied-buffer  send messages using a user-supplied buffer
  -c, --config=FILE           Use LBM configuration file FILE.
                              Multiple config files are allowed.
                              Example:  '-c file1.cfg -c file2.cfg'
  -d, --delay=NUM             delay sending for NUM seconds after smart source creation
  -D, --deregister             deregister the smart source after sending messages
  -h, --help                  display this help and exit
  -i, --int-mprop=VAL,KEY     send integer message property value VAL with name KEY
  -j, --late-join             turn on UME late join
  -f, --flight-size=NUM       allow NUM unstabilized messages in flight (determines message rate)
  -l, --length=NUM            send messages of NUM bytes
  -L, --linger=NUM            linger for NUM seconds before closing context
  -M, --messages=NUM          send NUM messages
  -m, --message-rate=NUM      send at NUM messages per second if allowed by the flight size settin
  -N, --channel=NUM           send on channel NUM
  -n, --non-block             use non-blocking I/O
  -P, --pause=NUM             pause NUM milliseconds after each send
  -Q, --seqnum-info           display sequence number information from smart source events
  -s, --statistics=NUM        print statistics every NUM seconds
  -S, --store=IP              use specified UME store
  -t, --storename=NAME        use specified UME store
  -v, --verbose               print additional info in verbose form
  -V, --verifiable            construct verifiable messages

Monitoring options:
  --monitor-src=NUM             monitor source every NUM seconds
  --monitor-ctx=NUM             monitor context every NUM seconds
  --monitor-transport=TRANS     use monitor transport module TRANS
                                TRANS may be 'lbm', 'lbmsnmp', or 'udp', default is 'lbm'
  --monitor-transport-opts=OPTS  use OPTS as transport module options
  --monitor-format=FMT          use monitor format module FMT
                                FMT may be 'csv' or 'pb'
  --monitor-format-opts=OPTS    use OPTS as format module options
  --monitor-appid=ID            use ID as application ID string


Transport and format options are passed as name=value pairs, separated by a semicolon.
The entire option string should be enclosed in double-quotes.


LBM transport options:
Note that individual LBM options can be specified as <scope>|<option>=value, where
```

```
  <scope> is one of context, source, receiver, wildcard_receiver, or event_queue
  <option> is the LBM configuration option name
The vertical bar (pipe symbol) is required when specifying individual LBM options.
  config=FILE           use LBM configuration file FILE
  topic=TOPIC           send statistics on topic TOPIC
                        default is /29west/statistics
  allow_debug=VAL       VAL may be 'off' or 'on'
                        defaults to 'off'


LBMSNMP transport options:
Note that individual LBM options can be specified as <scope>|<option>=value, where
  <scope> is one of context, source, receiver, wildcard_receiver, or event_queue
  <option> is the LBM configuration option name
The vertical bar (pipe symbol) is required when specifying individual LBM options.
  config=FILE           use LBM configuration file FILE
  topic=TOPIC           send statistics on topic TOPIC
                        default is /29west/statistics


UDP transport options:
  address=IP            send statistics to address IP
  port=NUM              send to UDP port NUM
                        default is 2933
  mcgroup=GRP           send on multicast group GRP
  bcaddress=IP          send statistics to broadcast address IP
  ttl=NUM               send multicast statistics with TTL NUM
                        default is 16


CSV format options:
  separator=CHAR        separate CSV fields with character CHAR
                        defaults to ','
                        Don't use a semicolon!


PB format options:
  filters=FILE          use FILE that contains filter options
```

1.7.56 Example umestored_example.c

Source code: umestored_example.c

```
umestored_example.c: application that shows how to call the
  umestored_main API to start a UMP store daemon.
```

1.7.57 Example umqrcv.c

Source code: umqrcv.c

```
Purpose: application that receives brokered queuing messages from a single topic.
Usage: umqrcv [options] topic
Available options:
  -A, --ascii           display messages as ASCII text (-A -A for newlines after each msg)
  -B, --broker=address  use broker given by address
  -c, --config=FILE     use FILE as LBM configuration file
```

```
  -D, --dereg             deregister upon exit
  -d, --delay=NUM          delay receiver creation NUM seconds from context creation
  -E, --exit              exit after source ends
  -h, --help              display this help and exit
  -I, --type-id=ID        set Receiver Type ID to ID
  --max-sources=num       allow num sources (for statistics gathering purposes)
  -r, --msgs=NUM          delete receiver after NUM messages
  -s, --statistics=NUM    print statistics every NUM seconds, along with bandwidth
  -S, --stop              exit after source ends, print throughput summary
  -X, --index             reserve given index if possible, or leave blank to reserve random index
  -v, --verbose           be verbose about incoming messages
                          (-v -v = be even more verbose)
  -V, --verify            verify message contents


Monitoring options:
  --monitor-rcv=NUM            monitor receiver every NUM seconds
  --monitor-ctx=NUM            monitor context every NUM seconds
  --monitor-transport=TRANS    use monitor transport module TRANS
                               TRANS may be 'lbm', 'lbmsnmp', or 'udp', default is 'lbm'
  --monitor-transport-opts=OPTS  use OPTS as transport module options
  --monitor-format=FMT         use monitor format module FMT
                               FMT may be 'csv' or 'pb'
  --monitor-format-opts=OPTS   use OPTS as format module options
  --monitor-appid=ID           use ID as application ID string


Transport and format options are passed as name=value pairs, separated by a semicolon.
The entire option string should be enclosed in double-quotes.


LBM transport options:
Note that individual LBM options can be specified as <scope>|<option>=value, where
  <scope> is one of context, source, receiver, wildcard_receiver, or event_queue
  <option> is the LBM configuration option name
The vertical bar (pipe symbol) is required when specifying individual LBM options.
  config=FILE          use LBM configuration file FILE
  topic=TOPIC          send statistics on topic TOPIC
                       default is /29west/statistics
  allow_debug=VAL      VAL may be 'off' or 'on'
                       defaults to 'off'


LBMSNMP transport options:
Note that individual LBM options can be specified as <scope>|<option>=value, where
  <scope> is one of context, source, receiver, wildcard_receiver, or event_queue
  <option> is the LBM configuration option name
The vertical bar (pipe symbol) is required when specifying individual LBM options.
  config=FILE          use LBM configuration file FILE
  topic=TOPIC          send statistics on topic TOPIC
                       default is /29west/statistics


UDP transport options:
  address=IP           send statistics to address IP
  port=NUM             send to UDP port NUM
                       default is 2933
  mcgroup=GRP          send on multicast group GRP
  bcaddress=IP         send statistics to broadcast address IP
  ttl=NUM              send multicast statistics with TTL NUM
                       default is 16


CSV format options:
  separator=CHAR       separate CSV fields with character CHAR
                       defaults to ','
                       Don't use a semicolon!
```

```
PB format options:
  filters=FILE            use FILE that contains filter options
```

1.7.58 Example umqsrc.c

Source code: umqsrc.c

```
Purpose: umqsrc.c: application that sends brokered queuing messages to a single
    topic at a specified rate.
Usage: umqsrc [options] topic
Available options:
  -A, --appsets=CFG       use ULB Application Sets given by CFG
  -B, --broker=address    use broker given by address
  -c, --config=FILE       use LBM configuration file FILE
  -d, --delay=NUM         delay sending for NUM seconds after source creation
  -h, --help              display this help and exit
  -f, --flight-size=NUM   allow NUM unstabilized messages in flight (determines message rate)
  -i, --ids               display Message IDs for sent message
  -l, --length=NUM        send messages of NUM bytes
  -L, --linger=NUM        linger for NUM seconds before closing context
  -M, --messages=NUM      send NUM messages
  -m, --message-rate=NUM  send at NUM messages per second
  -N, --seq-num           display sequence number information
  -n, --non-block         use non-blocking I/O
  -P, --pause=NUM         pause NUM milliseconds after each send
  -R, --rate=[UM]DATA/RETR  Set transport type to LBT-R[UM], set data rate limit to
                          DATA bits per second, and set retransmit rate limit to
                          RETR bits per second.  For both limits, the optional
                          k, m, and g suffixes may be used.  For example,
                          '-R 1m/500k' is the same as '-R 1000000/500000'
  -s, --statistics=NUM    print statistics every NUM seconds
  -v, --verbose           print additional info in verbose form
  -V, --verifiable        construct verifiable messages
  -X, --index             Send messages on specified index for ULB sources
  -Y, --broker-index       Send messages on specified named index for broker sources
```

1.8 Example Protocol Files

Google protocol buffer definition files. See **Monitoring Formats**.

1.8.1 Example dro_mon.proto

Source code: dro_mon.proto

1.8.2 Example um_mon_attributes.proto

Source code: um_mon_attributes.proto

1.8.3 Example um_mon_control.proto

Source code: um_mon_control.proto

1.8.4 Example ump_mon.proto

Source code: ump_mon.proto

1.8.5 Example ums_mon.proto

Source code: ums_mon.proto