Open Object Rexx™

RxSock TCP/IP Socket Functions Reference

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Thanks to Julian Choy for the ooRexx logo design.

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About This Book

This book describes the Open Object Rexx™ TCP/IP Sockets Function Library. .

This book is intended for people who plan to develop applications using Rexx and TCP/IP sockets. Its users range from the novice, who might have experience in some programming language but no Rexx or sockets experience, to the experienced application developer, who might have had some experience with Object Rexx and sockets.

This book is a reference rather than a tutorial. It assumes you are already familiar with object-oriented programming concepts.

Descriptions include the use and syntax of the language and explain how the language processor "interprets" the language as a program is running.

1. Related Information

See also: *Open Object Rexx: Reference*

2. How to Read the Syntax Diagrams

Throughout this book, syntax is described using the structure defined below.

- Read the syntax diagrams from left to right, from top to bottom, following the path of the line.

  The >>--- symbol indicates the beginning of a statement.

  The ---> symbol indicates that the statement syntax is continued on the next line.

  The >--- symbol indicates that a statement is continued from the previous line.

  The --->< symbol indicates the end of a statement.

  Diagrams of syntactical units other than complete statements start with the >--- symbol and end with the ---> symbol.

- Required items appear on the horizontal line (the main path).

```
>>-STATEMENT--required_item-------------------------------------><
```

- Optional items appear below the main path.

```
>>-STATEMENT--+---------------+---------------------------------><
              +-optional_item-+
```

- If you can choose from two or more items, they appear vertically, in a stack. If you must choose one of the items, one item of the stack appears on the main path.

```
>>-STATEMENT--+-required_choice1-+-----------------------------><
              +-required_choice2-+
```

- If choosing one of the items is optional, the entire stack appears below the main path.

```
>>-STATEMENT--+-----------------+-----------------------------><
              +-optional_choice1-+
```

```
              +-optional_choice2-+
```

- If one of the items is the default, it appears above the main path and the remaining choices are shown below.

```
              +-default_choice--+
>>-STATEMENT--+-----------------+----------------------------><
              +-optional_choice-+
              +-optional_choice-+
```

- An arrow returning to the left above the main line indicates an item that can be repeated.

```
              +-----------------+
              V                 |
>>-STATEMENT----repeatable_item-+----------------------------><
```

  A repeat arrow above a stack indicates that you can repeat the items in the stack.

- A set of vertical bars around an item indicates that the item is a fragment, a part of the syntax diagram that appears in greater detail below the main diagram.

```
>>-STATEMENT--| fragment |-------------------------------------><
```

  fragment:

```
|--expansion_provides_greater_detail----------------------------|
```

- Keywords appear in uppercase (for example, `PARM1`). They must be spelled exactly as shown but you can type them in upper, lower, or mixed case. Variables appear in all lowercase letters (for example, `parmx`). They represent user-supplied names or values.
- If punctuation marks, parentheses, arithmetic operators, or such symbols are shown, you must enter them as part of the syntax.

The following example shows how the syntax is described:

```
        +-,------+
        V        |
>>-MAX(----number-+--)-----------------------------------------><
```

3. A Note About Program Examples in this Document

The program examples in this document are rendered in a mono-spaced font that is not completely compatible for cut-and-paste functionality. Pasting text into an editor could result in some characters outside of the standard ASCII character set. Specifically, single-quote and double-quote characters are sometimes converted incorrectly when pasted into an editor.

4. Getting Help

The Open Object Rexx Project has a number of methods to obtain help for ooRexx. These methods, in no particular order of preference, are listed below.

4.1. The Rexx Language Association Mailing List

The *Rexx Language Association* (http://www.rexxla.org/) maintains a mailing list for its members. This mailing list is only available to RexxLA members thus you will need to join RexxLA in order to get on the list. The dues for RexxLA membership are small and are charged on a yearly basis. For details on joining RexxLA please refer to the *RexxLA Home Page* (http://rexxla.org/) or the *RexxLA Membership Application* (http://www.rexxla.org/rexxla/join.html) page.

4.2. The Open Object Rexx SourceForge Site

The Open Object Rexx Project (http://www.oorexx.org/) utilizes *SourceForge* (http://sourceforge.net/) to house the *ooRexx Project* (http://sourceforge.net/projects/oorexx) source repositories, mailing lists and other project features. Here is a list of some of the most useful facilities.

The ooRexx Forums

> The ooRexx project maintains a set of forums that anyone may contribute to or monitor. They are located on the *ooRexx Forums* (http://sourceforge.net/forum/?group_id=119701) page. There are currently three forums available: Help, Developers and Open Discussion. In addition, you can monitor the forums via email.

The Developer Mailing List

> You can subscribe to the oorexx-devel mailing list at *ooRexx Mailing List Subscriptions* (http://sourceforge.net/mail/?group_id=119701) page. This list is for discussing ooRexx project development activities and future interpreter enhancements. It also supports a historical archive of past messages.

The Users Mailing List

> You can subscribe to the oorexx-users mailing list at *ooRexx Mailing List Subscriptions* (http://sourceforge.net/mail/?group_id=119701) page. This list is for discussing using ooRexx. It also supports a historical archive of past messages.

The Announcements Mailing List

> You can subscribe to the oorexx-announce mailing list at *ooRexx Mailing List Subscriptions* (http://sourceforge.net/mail/?group_id=119701) page. This list is only used to announce significant ooRexx project events.

The Bug Mailing List

> You can subscribe to the oorexx-bugs mailing list at *ooRexx Mailing List Subscriptions* (http://sourceforge.net/mail/?group_id=119701) page. This list is only used for monitoring changes to the ooRexx bug tracking system.

Bug Reports

> You can create a bug report at *ooRexx Bug Report* (http://sourceforge.net/tracker/?group_id=119701&atid=684730) page. Please try to provide as much information in the bug report as possible so that the developers can determine the problem as

quickly as possible. Sample programs that can reproduce your problem will make it easier to debug reported problems.

Request For Enhancement

You can suggest ooRexx features at the *ooRexx Feature Requests* (http://sourceforge.net/tracker/?group_id=119701&atid=684733) page.

Patch Reports

If you create an enhancement patch for ooRexx please post the patch using the *ooRexx Patch Report* (http://sourceforge.net/tracker/?group_id=119701&atid=684732) page. Please provide as much information in the patch report as possible so that the developers can evaluate the enhancement as quickly as possible.

Please do not post bug patches here, instead you should open a bug report and attach the patch to it.

4.3. comp.lang.rexx Newsgroup

The comp.lang.rexx (news:comp.lang.rexx) newsgroup is a good place to obtain help from many individuals within the Rexx community. You can obtain help on Open Object Rexx or on any number of other Rexx interpreters and tools.

Chapter 1. What is RxSock?

RxSock is a Rexx function package providing access to the TCP/IP socket APIs available to the C programming environment. Most of the functions described in this reference are similar to the corresponding C functions available in the TCP/IP socket library.

It is assumed that you are familiar with the basic socket APIs and can reference those specific to the system. For more information, refer to the book *Internetworking with TCP/IP, Volume I: Principles, Protocols and Architecture* by Douglas Comer (Prentice Hall PTR).

The RxSock package requires TCP/IP support to be active on your system.

Chapter 2. Installation and Removal

The RxSock package is contained in the file rxsock.dll. This file must be placed in a directory listed in your LIBPATH. To get access to the functions in the RxSock package, execute the following Rexx code:

```
If RxFuncQuery("SockDropFuncs") then
do
   rc = RxFuncAdd("SockLoadFuncs","rxsock","SockLoadFuncs")
   rc = SockLoadFuncs()
end
```

To unload the DLL, call the SockDropFuncs() function and then exit all CMD.EXE shells. After exiting all command shells, the DLL is dropped by the system and can be deleted or replaced.

Chapter 3. Parameters and Return Values

Unless otherwise stated, the return values are the same as for the corresponding C functions. The following standard parameter types are referred to throughout this reference:

socket

is a socket value, which is an integral number.

domain

is a domain value. Currently, only the domain AF_INET is supported.

address

is the stem of a stem variable with the following values:

address.family

must always be AF_INET.

address.port

is a port number.

address.addr

is a dotted decimal address or INADDR_ANY, where appropriate.

When this parameter is needed, set it the name of a stem variable for the function to set (or that the function will read from). For example, if you pass the string xxx.! as a parameter, the following variables are set or queried by the function:
"xxx.!family"
"xxx.!port"
"xxx.!addr"

A null address is an address with the family field being AF_INET, the port field being 0, and the addr field being 0.0.0.0.

dotAddress

is the standard dotted decimal address. For example, the string 9.23.19.63 is a valid address.

host

is the stem of a stem variable with the following values:

host.name

is the standard name of the host.

host.alias.0

is the number of aliases for this host.

host.alias.1

is the first alias for this host.

host.alias.n

is the nth alias for this host.

host.addrtype

must always be AF_INET.

host.addr

is a dotted decimal address (default address).

host.addr.0

is the number of addresses for this host.

host.addr.1

is the first address for this host.

host.addr.n

is the nth address for this host.

When this parameter is needed, set it the name of a stem variable for the function to set (or that the function will read from). For example, if you pass the string xxx.! as a parameter, the following variables are set or queried by the function:
"xxx.!name"
"xxx.!alias.0", "xxx.!alias.1" ... "xxx.!alias.n"
"xxx.!addrtype"
"xxx.!addr"
"xxx.!addr.0", "xxx.!addr.1" ... "xxx.!addr.n"

3.1. Stem Variables

The address and host type of a parameter are stems of a stem variable. Normally, when you pass a string like addr. as a parameter, you expect the variables addr.family, addr.port, and addr.addr to be set by the function. In the previous examples, however, the stem contained an exclamation mark. This exclamation mark helps prevent the value that follows from getting misused as a normal variable. Example:

```
port = 923
sNew = SockAccept(sOld,"addr.")
say addr.port
```

In this example, you might expect the say statement to write the port number of the accepted socket. Instead, it writes the value of the variable, namely addr.923, because the port variable is set to this value.

Because exclamation marks are rarely used in variables, it is unlikely that the variable !port is used in your program.

Note: Do not use the characters _, 0, and 1 to prefix tail values. 0 and 1 are difficult to distinguish from O, I, and l.

Chapter 4. Special Variables

The following variables are maintained by the system: errno and h_errno.

Variable *errno*

The variable errno is set after each RxSock call. It can have one of the following values or any other numeric value:

- EWOULDBLOCK
- EINPROGRESS
- EALREADY
- ENOTSOCK
- EDESTADDRREQ
- EMSGSIZE
- EPROTOTYPE
- ENOPROTOOPT
- EPROTONOSUPPORT
- ESOCKTNOSUPPORT
- EOPNOTSUPP
- EPFNOSUPPORT
- EAFNOSUPPORT
- EADDRINUSE
- EADDRNOTAVAIL
- ENETDOWN
- ENETUNREACH
- ENETRESET
- ECONNABORTED
- ECONNRESET
- ENOBUFS
- EISCONN
- ENOTCONN
- ESHUTDOWN
- ETOOMANYREFS
- ETIMEDOUT
- ECONNREFUSED
- ELOOP

- ENAMETOOLONG
- EHOSTDOWN
- EHOSTUNREACH
- ENOTEMPTY

Note: The value is set even if the function called does not set the variable, in which case the value has no meaning. A value of 0 indicates that no error occurred.

Variable *h_errno*

The variable h_errno is set after each RxSock call. It can have one of the following values or any other numeric value:

- HOST_NOT_FOUND
- TRY_AGAIN
- NO_RECOVERY
- NO_ADDRESS

Note: The value is set even if the function called does not set the variable, in which case the value has no meaning. A value of 0 indicates that no error occurred.

Chapter 5. Function Reference

The following sections describe how the individual functions contained in RxSock are invoked from the Rexx programming environment:

5.1. SockLoadFuncs

The SockLoadFuncs() call loads all RxSock functions.

Syntax:

```
>>--SockLoadFuncs(--+--------+--)---------------------------------------><
                    +--parm--+
```

All parameters that you supply are only used to bypass copyright information.

5.2. SockDropFuncs

The SockDropFuncs call drops all RxSock functions.

Syntax:

```
SockDropFuncs()
```

To unload the dynamic load library (DLL), first call SockDropFuncs() and then exit all CMD.EXE shells. After exiting all command shells, the DLL is dropped by the system and can be deleted or replaced.

5.3. SockVersion

The SockVersion() call provides the version of RxSock.

Syntax:

```
>>--SockVersion()-------------------------------------------------------><
```

Return Values:

The returned value is in the form version.subversion, for example 2.1.

Prior to Version 1.2, this function did not exist. To check if a former version of Rxsock is installed, use the following code after loading the function package with SockLoadFuncs():

```
/* oldVersion is 1 if a version of RxSock < 1.2 is loaded */
oldVersion = (1 = RxFuncQuery("SockVersion"))
```

5.4. SockAccept

The SockAccept() call accepts a connection request from a remote host.

Syntax:

```
>>--SockAccept(socket--+-------------+--)--------------------------------><
                       +--, address--+
```

where:

socket

is the socket descriptor created with the SockSocket() call. It is bound to an address using the SockBind() call and must be enabled to accept connections using theSockListen() call.

address

is a stem variable that contains the socket address of the connection client when the SockAccept() call returns. This parameter is optional.

SockAccept() is used by a server in a connection-oriented mode to accept a connection request from a client. The call accepts the first connection on its queue of pending connection requests. It creates a new socket descriptor with the same properties as socket and returns it to the caller. This new socket descriptor cannot be used to accept new connections. Only the original socket can accept more connection requests.

If the queue has no pending connection requests, SockAccept() blocks the caller unless the socket is in nonblocking mode. If no connection requests are queued and the socket is in nonblocking mode, SockAccept() returns a value of -1 and sets the return code to the value EWOULDBLOCK.

You cannot get information on requesters without calling SockAccept(). The application cannot tell the system from which requesters it will accept connections. The caller can close a connection immediately after identifying the requester.

The SockSelect() call can be used to check the socket for incoming connection requests.

Return Values:

A positive value indicates successful execution of the call. The value -1 indicates an error. You can get the specific error code by calling SockSock_Errno() or SockPSock_Errno(). Possible values:

ENOTSOCK

socket is not a valid socket descriptor.

EINTR

Interrupted system call.

EINVAL

SockListen() was not called for socket.

EOPNOTSUPP

socket is not connection-oriented.

EWOULDBLOCK

socket is in nonblocking mode, and there are no connection requests queued.

ECONNABORTED

The software caused a connection close.

Note: SockAccept() interfaces with the C function accept().

5.5. SockBind

The SockBind() call binds a local name to the socket.

Syntax:

```
>>--SockBind(socket, address)-------------------------------------------><
```

where:

socket

is the socket descriptor returned by a previous call to SockSocket().

address

is a stem variable containing the address that is to be bound to socket.

SockBind() binds the unique local name address to the socket with descriptor socket. After calling SockSocket(), a descriptor does not have a name. However, it belongs to a particular address family that you specified when calling SockSocket().

Because socket was created in the AF_INET domain, the fields of the stem address are as follows:

The family field must be set to AF_INET. The port field is set to the port to which the application must bind. If port is set to 0, the caller allows the system to assign an available port. The application can call SockGetSockName() to discover the port number assigned. The addr field is set to the Internet address. On hosts with more than one network interface (called multihomed hosts), a caller can select the interface with which it is to bind.

Only UDP packets and TCP connection requests from this interface that match the bound name are routed to the application. This is important when a server offers a service to several networks. If addr is set to INADDR_ANY, the caller requests socket be bound to all network interfaces on the host. If you do not specify an address, the server can accept all UDP packets and TCP connection requests made to its port, regardless of the network interface on which the requests arrived.

Return values:

The value 0 indicates successful execution of the call. The value -1 indicates an error. You can get the specific error code by calling SockSock_Errno() or SockPSock_Errno(). Possible values:

EADDRINUSE

address is already in use. See the SO_REUSEADDR option described under SockGetSockOpt() and the SO_REUSEADDR option described under SockSetSockOpt().

EADDRNOTAVAIL

The address specified is not valid on this host. For example, the Internet address does not specify a valid network interface.

EAFNOSUPPORT

The address family is not supported.

ENOTSOCK

socket is not a valid socket descriptor.

EINVAL

socket is already bound to an address.

ENOBUFS

No buffer space available.

Note: SockBind() interfaces with the C function bind().

5.6. SockClose

The SockClose() call shuts down a socket and frees resources allocated to the socket.

Syntax

```
>>--SockClose(socket)-----------------------------------------------><
```

where:

socket

is the descriptor of the socket to be closed.

If the SO_LINGER option of SockSetSockOpt() is enabled, any queued data is sent. If this option is disabled, any queued data is flushed.

Return values:

The value 0 indicates successful execution of the call. The value -1 indicates an error. You can get the specific error code by calling SockSock_Errno() or SockPSock_Errno(). Possible values are:

ENOTSOCK

socket is not a valid socket descriptor.

EALREADY

The socket is in nonblocking mode. A previous connection attempt has not completed.

SockClose() is exactly the same as SockSoClose().

Note: SockClose() interfaces with the C function soclose() or, in the Windows environments, with closesocket().

5.7. SockConnect

The SockConnect() socket call requests a connection to a remote host.

Syntax:

```
>>--SockConnect(socket, address)----------------------------------------><
```

where:

socket

is the socket descriptor used to issue the connection request.

address

is a stem variable containing the address of the socket to which a connection is to be established.

The SockConnect() call performs the following tasks when called for a stream socket:

1. It completes the binding for a socket, if necessary.
2. It attempts to create a connection between two sockets.

This call is used by the client side of socket-based applications to establish a connection with a server. The remote server must have a passive open pending, which means it must successfully call SockBind() and SockListen(). Otherwise, SockConnect() returns the value -1 and the error value is set to ECONNREFUSED.

In the Internet communication domain, a timeout occurs if a connection to the remote host is not established within 75 seconds.

If the socket is in blocking mode, the SockConnect() call blocks the caller until the connection is established or an error is received. If the socket is in nonblocking mode, SockConnect() returns the value -1 and sets the error value to EINPROGRESS if the connection was successfully initiated. The caller can test the completion of the connection by calling:

- SockSelect(), to test for the ability to write to the socket
- SockGetsockOpt(), with option SO_ERROR, to test if the connection was established

Stream sockets can call SockConnect() only once.

Datagram or raw sockets normally transfer data without being connected to the sender or receiver. However, an application can connect to such a socket by calling SockConnect(). SockConnect() specifies and stores the destination peer address for the socket. The system then knows to which address to send data and the destination peer address does not have to be specified for each datagram sent. The address is kept until the next SockConnect() call. This permits the use of the SockRecv() and SockSend() calls, which are usually reserved for connection-oriented sockets. However, data is still not necessarily delivered, which means the normal features of sockets using connectionless data transfer are maintained. The application can therefore still use the SockSendTo()and SockRecvFrom() calls.

Datagram and raw sockets can call SockConnect() several times. The application can change their destination address by specifying a new address on the SockConnect() call. In addition, the socket can be returned to a connectionless mode by calling SockConnect() with a null destination address. The null

address is created by setting the stem variable address as follows: the family field to AF_INET, the port field to 0, and the addr field to 0.0.0.0.

The call to SockConnect returns the value -1, indicating that the connection to the null address cannot be established. Calling SockSock_Errno() returns the value EADDRNOTAVAIL.

Return values:

The value 0 indicates successful execution of the call. The value -1 indicates an error. You can get the specific error code by calling SockSock_Errno() or SockPSock_Errno(). Possible values are:

EADDRNOTAVAIL

The calling host cannot reach the specified destination.

EAFNOSUPPORT

The address family is not supported.

EALREADY

The socket is in nonblocking mode. A previous connection attempt has not completed.

ENOTSOCK

The socket is not a valid socket descriptor.

ECONNREFUSED

The destination host rejected the connection request.

EINPROGRESS

socket is in nonblocking mode, and the connection cannot be completed immediately. EINPROGRESS does not indicate an error.

EINTR

Interrupted system call.

EISCONN

socket is already connected.

ENETUNREACH

The network cannot be reached from this host.

ETIMEDOUT

Establishing the connection timed out.

ENOBUFS

There is no buffer space available.

EOPNOTSUPP

The operation is not supported on socket.

Note: SockConnect interfaces with the C function connect().

5.8. SockGetHostByAddr

The SockGetHostByAddr() call retrieves information about a specific host using its address.

Syntax:

```
>>--SockGetHostByAddr(dotAddress, host--+------------+--)---------------><
                                        +--, domain--+
```

where:

dotAddress

is the standard dotted decimal address of the host.

host

is a stem variable that is to receive the information on the host.

domain

is the domain AF_INET. This parameter is optional.

Return values:

The value 1 indicates successful execution of the call. The value 0 indicates an error.

Note: SockGetHostByAdress() interfaces with the C function gethostbyaddr().

5.9. SockGetHostByName

The SockGetHostByName() call retrieves host information on a specific host using its name or any alias.

Syntax:

```
>>--SockGetHostByName(nameAddress, host)--------------------------------><
```

where:

nameAddress

is the name of a host, for example www.ibm.com.

host

is the name of a stem variable to receive the information on the host.

Return values:

The value 1 indicates successful execution of the call. The value 0 indicates an error.

Note: SockGetHostByName() interfaces with the C function gethostbyname().

5.10. SockGetHostId

The SockGetHostId() call retrieves the dotAddress of the local host.

Syntax:

```
>>--SockGetHostId()-------------------------------------------------------><
```

The return value is the dotAddress of the local host.

Note: SockGetHostId() interfaces with the C function gethostid().

5.11. SockGetPeerName

The SockGetPeerName() call gets the name of the peer connected to a socket.

Syntax:

```
>>--SockGetPeerName(socket, address)--------------------------------------><
```

where:

socket

is the socket descriptor.

address

is a stem variable that will contain the address of the peer connected to socket.

Return values:

The value 0 indicates successful execution of the call. The value -1 indicates an error. You can get the specific error code by calling SockSock_Errno() or SockPSock_Errno(). Possible values are:

ENOTSOCK

socket is not a valid socket descriptor.

ENOTCONN

socket is not connected.

ENOBUFS

There is no buffer space available.

Note: SockGetPeerName() interfaces with the C function getpeername().

5.12. SockGetSockName

The SockGetSockName() call gets the local socket name.

Syntax:

```
>>--SockGetSockName(socket, address)-------------------------------------><
```

where:

socket

is the socket descriptor.

address

is a stem variable that is to receive the address of the socket returned.

SockGetSockName() returns the address for socket in the stem variable address. If the socket is not bound to an address, the call returns a null address.

The returned null address is a stem variable with the family field set to AF_INET, the port field set to 0, and the addr field set to 0.0.0.0.

All sockets are explicitly assigned an address after a successful call to SockBind(). Stream sockets are implicitly assigned an address after a successful call to SockConnect() or SockAccept() if SockBind() was not called.

The SockGetSockName() call is often used to identify the port assigned to a socket after the socket has been implicitly bound to a port. For example, an application can call SockConnect() without previously calling SockBind(). In this case, the SockConnect() call completes the binding necessary by assigning a port to the socket.

Return values:

The value 0 indicates successful execution of the call. The value -1 indicates an error. You can get the specific error code by calling SockSock_Errno() or SockPSock_Errno(). Possible values are:

ENOTSOCK

socket is not a valid socket descriptor.

ENOBUFS

There is no buffer space available.

Note: SockGetSockName() interfaces with the C function getsockname().

5.13. SockGetSockOpt

The SockGetSockOpt() call gets the socket options associated with a socket.

Syntax:

```
>>--SockGetSockOpt(socket, level, optName, optVal)----------------------><
```

where:

socket

is the socket descriptor.

level

specifies which option level is queried for the specified optname. The only supported level is SOL_SOCKET.

optname

is the name of the specified socket option. Only one option can be specified with a call.

optval

is the variable to receive the option values requested. For socket options that are Boolean the option is enabled if optval is nonzero and disabled if optval is 0.

SockGetSockOpt() returns the value of a socket option at the socket level. It can be requested for sockets of all domain types. Some options are supported only for specific socket types.

The following options are recognized for SOL_SOCKET:

SO_BROADCAST

returns the information whether datagram sockets are able to broadcast messages. If this option is enabled, the application can send broadcast messages using datagram socket, if the interface specified in the destination supports broadcasting of packets.

SO_DEBUG

returns the information whether debug information can be recorded for a socket.

SO_DONTROUTE

returns the information whether the socket is able to bypass the routing of outgoing messages. If this option is enabled, outgoing messages are directed to the network interface specified in the network portion of the destination address. When enabled, packets can only be sent to directly connected networks.

SO_ERROR

returns any error pending at the socket and clears the error status. It can be used to check for asynchronous errors at connected datagram sockets or for asynchronous errors that are not explicitly returned by one of the socket calls.

SO_KEEPALIVE

returns the information whether stream sockets are able to send keepalive packets. TCP uses a timer called the keepalive timer. This timer monitors idle connections that might have been disconnected because of a peer crash or timeout. If this option is enabled, a keepalive packet is periodically sent to the peer.

This option is mainly used to enable servers to close connections that are no longer active as a result of clients ending connections without properly closing them.

SO_LINGER

returns the information whether stream sockets are able to linger on close if data is present. If this option is enabled and there is data still to be sent when SockSoClose() is called, the calling application is blocked during the SockSoClose() call until the data is transmitted or the connection has timed out. If this option is disabled, the SockSoClose() call returns without blocking the caller while TCP is trying to send the data. Although the data transfer is usually successful, it cannot be guaranteed because TCP tries to send the data only for a specific amount of time.

SO_OOBINLINE

returns the information whether stream sockets are able to receive out-of-band data. If this option is enabled, out-of-band data is placed in the normal data input queue as it is received. It is then made available to SockRecv() and SockRecvFrom() without the MSG_OOB flag being specified in those calls. If this option is disabled, out-of-band data is placed in the priority data input queue as it is received. It can then only be made available to SockRecv() and SockRecvFrom() by specifying the MSG_OOB flag in those calls.

SO_RCVBUF

returns the buffer size for input.

SO_RCVLOWAT

returns the receive low-water mark.

SO_RCVTIMEO

returns the timeout value for a receive operation.

SO_REUSEADDR

returns the information whether stream and datagram sockets are able to reuse local addresses. If this option is enabled, the local addresses that are already in use can then be bound. This alters the normal algorithm used in the SockBind() call. At connection time, the system checks whether the local addresses and ports differ from foreign addresses and ports. If not, the error value EADDRINUSE is returned.

SO_SNDBUF

returns the size of the send buffer.

SO_SNDLOWAT

returns the send low-water mark. This mark is ignored for nonblocking calls and not used in the Internet domain.

SO_SNDTIMEO

returns the timeout value for a send operation.

SO_TYPE

returns the socket type. The integer pointed to by optval is then set to one of the following: STREAM, DGRAM, RAW, or UNKNOWN.

SO_USELOOPBACK

bypasses hardware where possible.

All option values are integral except for SO_LINGER, which contains the following blank-delimited integers:

- The l_onoff value. It is set to 0 if the SO_LINGER option is disabled.
- The l_linger value. It specifies the amount of time, in seconds, to be lingered on close. A value of 0 causes SockSoClose() to wait until disconnection completes.

Return values:

The value 0 indicates successful execution of the call. The value -1 indicates an error. You can get the specific error code by calling SockSock_Errno() or SockPSock_Errno(). Possible values are:

EADDRINUSE

The address is already in use.

ENOTSOCK

socket is not a valid socket descriptor.

ENOPROTOOPT

optname or level is not recognized.

Note: SockGetSockOpt() interfaces with the C function getsockopt().

5.14. SockInit

The SockInit() call initializes the socket data structures and checks whether the TCP/IP network is active.

Syntax:

```
>>--SockInit()-------------------------------------------------------><
```

SockInit() can be called at the beginning of each program that uses SockSocket(). However, it is not obligatory because each RxSock function is automatically initialized. For this reason, explicit initialization is not available in all system environments.

Return values:

The value 0 indicates successful execution of the call. The value 1 indicates an error.

> **Note:** SockInit() interfaces with the C function sock_init().

5.15. SockIoctl

The SockIoctl() call performs special operations on the socket.

Syntax:

```
>>--SockIoctl(socket, ioctlCmd, ioctlData)-------------------------------><
```

where:

socket

is the socket descriptor.

ioctlCmd

is the ioctl command to be performed.

ioctlData

is a variable containing data associated with the particular command. Its format depends on the command requested. Valid commands are:

FIONBIO

sets or clears nonblocking input or output for a socket. This command is an integer. If the integer is 0, nonblocking input or output on the socket is cleared. If the integer is a number other than 0, input or output calls do not block until the call is completed.

FIONREAD

gets the number of immediately readable bytes for the socket. This command is an integer.

Return values:

The value 0 indicates successful execution of the call. The value -1 indicates an error. You can get the specific error code SockSock_Errno() or SockPSock_Errno(). Possible values are:

ENOTSOCK

socket is not a valid socket descriptor.

EINVAL

The request is not valid or not supported.

EOPNOTSUPP

The operation is not supported on the socket.

Note: SockIoctl() interfaces with the C function ioctl() or, in the Windows environments, with ioctlsocket().

5.16. SockListen

The SockListen() call completes the binding necessary for a socket to accept connections and creates a connection request queue for incoming requests.

Syntax:

```
>>--SockListen(socket, backlog)-----------------------------------------><
```

where:

socket

is the socket descriptor.

backlog

controls the maximum queue length for pending connections.

SockListen() performs the following tasks:

1. 1. It completes the binding necessary for socket, if SockBind() has not been called for the socket.
2. It creates a connection request queue with a length of backlog to queue incoming connection requests.

When the queue is full, additional connection requests are ignored.

SockListen() can only be called for connection-oriented sockets.

SockListen() is called after allocating a socket with SockSocket() and after binding a name to socket with SockBind(). It must be called before SockAccept().

SockListen() indicates when it is ready to accept client connection requests. It transforms an active socket to a passive socket. After it is called, socket cannot be used as an active socket to initiate connection requests.

If backlog is smaller than 0, SockListen() interprets the backlog to be 0. If it is greater than the maximum value defined by the network system, SockListen() interprets the backlog to be this maximum value.

Return values:

The value 0 indicates successful execution of the call. The value -1 indicates an error. You can get the specific error code SockSock_Errno() or SockPSock_Errno(). Possible values are:

ENOTSOCK

socket is not a valid socket descriptor.

EOPNOTSUPP

socket is not a socket descriptor that supports the SockListen() call.

Note: SockListen() interfaces with the C function listen().

5.17. SockPSock_Errno

The SockPSock_Errno() call writes a short error message to the standard error device. It describes the last error encountered during a call to a socket library function.

Syntax:

```
>>--SockPSock_Errno(--+----------------+--)------------------------------><
                      +--error_string--+
```

where:

error_string

is the error string written to the standard error device describing the last error encountered. The string printed is followed by a colon, a space, and then the message. If it is omitted or empty, only the message is printed. The string is optional.

The error code is acquired by calling SockSock_Errno(). It is set when errors occur. Subsequent socket calls do not clear the error code.

Note: SockPSock_Errno() interfaces with the C function psock_errno().

5.18. SockRecv

The SockRecv() call receives data on a connected socket.

Syntax:

```
>>--SockRecv(socket, var, len--+-----------+--)-------------------------><
                               +--, flags--+
```

where:

socket

is the socket descriptor.

var

is the name of a Rexx variable to receive the data.

len

is the maximum amount of data to be read.

flags

is a blank-delimited list of options:

MSG_OOB

reads any out-of-band data on the socket.

MSG_PEEK

peeks at the data on the socket. The data is returned but not removed, so the subsequent receive operation sees the same data.

SockRecv() receives data on a socket with descriptor socket and stores it in the Rexx variable var. It applies only to connected sockets. For information on how to use SockRecv() with datagram and raw sockets, see Datagram or raw sockets.

SockRecv() returns the length of the incoming data. If a datagram is too long to fit the buffer, the excessive data is discarded. No data is discarded for stream sockets. If data is not available at socket, the SockRecv() call waits for a message and blocks the caller unless the socket is in nonblocking mode. See SockIoctl() for a description of how to set the nonblocking mode.

SockRecv() may return fewer bytes than requested. This is due to the underlying TCP/IP subsystem and is not controllable by the RxSock programmer. When you receive fewer bytes than you request you should follow immediately with another request for the balance of the requested bytes. You may have to call SockRecv() repeatedly to obtain all the bytes. Each subsequent call should request the difference between the previous request number of bytes and the number of bytes actually received.

Return values:

If successful, the length of the data in bytes is returned. The value 0 indicates that the connection is closed. The value -1 indicates an error. You can get the specific error code SockSock_Errno() or SockPSock_Errno(). Possible values are:

ENOTSOCK

socket is not a valid socket descriptor.

EINTR

Interrupted system call.

EINVAL

Invalid argument.

EWOULDBLOCK

socket is in nonblocking mode and no data is available, or the SO_RCVTIMEO option has been set for socket and the timeout expired before any data arrived.

Note: SockRecv() interfaces to the C function recv().

5.19. SockRecvFrom

The SockRecvFrom() call receives data on a socket.

Syntax:

```
>>--SockRecvFrom(socket, var, len--+-----------+--, address)-------------><
                                   +--, flags--+
```

where:

socket

is the socket descriptor.

var

is the name of a Rexx variable to receive the data.

len

is the maximum amount of data to be read.

flags

is a blank delimited list of options:

MSG_OOB

reads any out-of-band data on the socket.

MSG_PEEK

peeks at the data present on the socket. The data is returned but not consumed. The subsequent receive operation thus sees the same data.

address

is a stem variable specifying the address of the sender from which the data is received, unless it is a null address.

SockRecvFrom() receives data on a socket with descriptor socket and stores it in a Rexx variable named var. It applies to any socket type, whether connected or not.

SockRecvFrom() returns the length of the incoming message or data. If a datagram is too long to fit the supplied buffer, the excessive data is discarded. No data is discarded for stream sockets. If data is not available at socket, the SockRecvFrom() call waits for a message to arrive and blocks the caller, unless the socket is in nonblocking mode. See SockIoctl() for a description of how to set the nonblocking mode.

Return values:

If successful, the length of the data in bytes is returned. The value -1 indicates an error. You can get the specific error code SockSock_Errno() or SockPSock_Errno(). Possible values are:

ENOTSOCK

socket is not a valid socket descriptor.

EINVAL

Invalid argument.

EWOULDBLOCK

socket is in nonblocking mode, no data is available, or the SO_RCVTIMEO option has been set for socket and the timeout expired before data arrived.

Note: SockRecvFrom() interfaces with the C function recvfrom().

5.20. SockSelect

The SockSelect() call monitors the activity on a socket with regard to readability, readiness for writing, and pending exceptional conditions.

Syntax:

```
>>--SockSelect(reads, writes, excepts--+-------------+--)----------------><
                                       +--, timeout--+
```

where:

reads

is the number of sockets to be checked for readability.

writes

is the number of sockets to be checked for readiness for writing.

excepts

is the number of sockets to be checked for pending exceptional conditions. For Network Services sockets, the only pending exceptional condition is out-of-band data in the receive buffer.

timeout

is the maximum number of seconds the system waits for the selection to complete. Set the timeout parameter to 0 for a blocking operation. If the socket is ready, the return will be immediate.

Each parameter specifying a number of sockets is qualified by a stem variable which is queried and set by this function. The stem variable has the following format: stem.0 contains the number of sockets, stem.1 the first socket, and so on. Upon return, the stem variables are reset to the sockets that are ready. If any of the stem variables are empty (), or no parameter is passed, no sockets for that type are checked.

The timeout value must be integral (no fractional values). Nonnumeric and negative numbers are considered to be 0. If no timeout value is passed, an empty string () is assumed.

If the timeout value is 0, SockSelect() does not wait before returning. If the timeout value is an empty string (), SockSelect() does not time out, but returns when a socket becomes ready. If the timeout value is in seconds, SockSelect() waits for the specified interval before returning. It checks all indicated sockets at the same time and returns as soon as one of them is ready.

Return values:

The number of ready sockets is returned. The value 0 indicates an expired time limit. In this case, the stem variables are not modified. The value -1 indicates an error. You can get the specific error code SockSock_Errno() or SockPSock_Errno(). Possible values are:

ENOTSOCK

socket is not a valid socket descriptor.

EFAULT

The address is not valid.

EINVAL

Invalid argument.

EINTR

Interrupted system call.

Examples:

```
r.0 = 2                    /* specify 2 sockets for read in stem r. */
```

```
r.1 = 101
r.2 = 102
                            /* specify 1 socket for write in stem w. */
w.0 = 1
w.1 = 103
                           /* no sockets for exceptions in stem e.    */
e.0 = 0
rc = SockSelect("r.","w.","e.")
do i = 1 to r.0           /* display sockets ready for read          */
    say "socket" r.i "is ready for reading."
end
```

That SockSelect() call can be invoked as:

```
rc = SockSelect("r.","w.","")
```

or

```
rc = SockSelect("r.","w.",)
```

The function call SockSelect(, , , x) results in the program pausing for x seconds.

Note: SockSelect() interfaces with the C function select().

5.21. SockSend

The SockSend() call sends data to a connected socket.

Syntax:

```
>>--SockSend(socket, data--+-----------+--)------------------------------><
                           +--, flags--+
```

where:

socket

is the socket descriptor.

data

is the name of a Rexx variable containing the data to be transmitted.

flags

is a blank delimited list of options:

MSG_OOB

sends out-of-band data to sockets that support SOCK_STREAM communication.

MSG_DONTROUTE

turns on the SO_DONTROUTE option for the duration of the send operation. This option is usually only used by diagnostic or routing programs.

SockSend() sends data to a connected socket with descriptor socket. For information on how to use SockSend() with datagram and raw sockets, see Datagram or raw sockets.

If the socket does not have enough buffer space to hold the data to be sent, the SockSend() call blocks unless the socket is placed in nonblocking mode. See SockIoctl() for a description of how to set the nonblocking mode. Use the SockSelect() call to determine when it is possible to send more data.

Return values:

If successful, the number of bytes of the socket with descriptor socket that is added to the send buffer is returned. Successful completion does not imply that the data has already been delivered to the receiver.

The return value -1 indicates that an error was detected on the sending side of the connection. You can get the specific error code SockSock_Errno() or SockPSock_Errno(). Possible values are:

ENOTSOCK

socket is not a valid socket descriptor.

EINTR

Interrupted system call.

EINVAL

Invalid argument.

ENOBUFS

There is no buffer space available to send the message.

EWOULDBLOCK

socket is in nonblocking mode, the data cannot be sent without blocking, or the SO_SNDTIMEO option has been set for socket and the timeout expired before any data was sent.

Note: SockSend() interfaces with the C function send().

5.22. SockSendTo

The SockSentTo() call sends data to a connected or unconnected socket.

Syntax:

```
>>--SockSendTo(socket, data--+-----------+--, address)-------------------><
                             +--, flags--+
```

where:

socket

is the socket descriptor.

data

is a string of data to be transmitted.

flags

is a blank delimited list of options:

MSG_OOB

sends out-of-band data to sockets that support SOCK_STREAM communication.

MSG_DONTROUTE

turns on the SO_DONTROUTE option for the duration of the send operation. This option is usually only used by diagnostic or routing programs.

address

is a stem variable containing the destination address.

SockSendTo() sends data to a connected or unconnected socket with descriptor socket. For unconnected datagram and raw sockets, it sends data to the specified destination address. For stream sockets, the destination address is ignored.

Datagram sockets are connected by calling SockConnect(). This call identifies the peer to send or receive the datagram. After a datagram socket is connected to a peer, you can still use the SockSendTo() call but you cannot include a destination address.

To change the peer address when using connected datagram sockets, issue SockConnect() with a null address. Specifying a null address removes the peer address specification. You can then issue either a SockSendTo() call and specify a different destination address or a SockConnect() call to connect to a different peer. For more information on connecting datagram sockets and specifying null addresses, see Datagram or raw sockets.

Return values:

If successful, the number of bytes sent is returned. Successful completion does not guarantee that the data is delivered to the receiver. The return value -1 indicates that an error was detected on the sending side. You can get the specific error code SockSock_Errno() or SockPSock_Errno(). Possible values are:

ENOTSOCK

socket is not a valid socket descriptor.

EMSGSIZE

The message data was too big to be sent as a single datagram.

ENOBUFS

There is no buffer space available to send the message.

EWOULDBLOCK

socket is in nonblocking mode, the data cannot be sent without blocking, or the SO_SNDTIMEO option has been set for socket and the timeout expired before any data was sent.

ENOTCONN

The socket is not connected.

EDESTADDRREQ

Destination address required.

Note: SockSendTo() interfaces with the C function sendto().

5.23. SockSetSockOpt

The SockSetSockOpt() call sets options associated with a socket.

Syntax:

```
>>--SockSetSockOpt(socket, level, optName, optVal)----------------------><
```

where:

socket

is the socket descriptor.

level

specifies which option level is set. The only supported level is SOL_SOCKET.

optname

is the name of a specified socket option.

optval

is the variable containing the data needed by the set command. It is optional.

SockSetSockOpt() sets options associated with a socket with descriptor socket such as enabling debugging at the socket or protocol level, controlling timeouts, or permitting socket data broadcasting. Options can exist at the socket or the protocol level. They are always present at the highest socket level. When setting socket options, the option level and name must be specified.

For socket options that are toggles, the option is enabled if optval is nonzero and disabled if optval is 0.

The following options are recognized for SOL_SOCKET:

SO_BROADCAST

enables datagram sockets to broadcast messages. The application can then send broadcast messages using datagram socket, if the interface specified in the destination supports broadcasting of packets.

SO_DEBUG

enables debug information to be recorded for a socket.

SO_DONTROUTE

enables the socket to bypass the routing of outgoing messages. Outgoing messages are then directed to the network interface specified in the network portion of the destination address. When enabled, packets can only be sent to directly connected networks.

SO_KEEPALIVE

enables stream sockets to send keepalive packets, which keep the connection alive. TCP uses a timer called the keepalive timer. This timer monitors idle connections that might have been disconnected because of a peer crash or timeout. If this option is enabled, a keepalive packet is periodically sent to the peer.

This option is mainly used to enable servers to close connections that are no longer active as a result of clients ending connections without properly closing them.

SO_LINGER

enables stream sockets to linger on close if data is present. If this option is enabled and there is data still to be sent when SockSoClose() is called, the calling application is blocked during the SockSoClose() call until the data is transmitted or the connection has timed out. If this option is disabled, the SockSoClose() call returns without blocking the caller while TCP is trying to send the data. Although the data transfer is usually successful, it cannot be guaranteed because TCP tries to send the data only for a specific amount of time.

SO_OOBINLINE

enables stream sockets to receive out-of-band data, which is a logically separate data path using the same connection as the normal data path. If this option is enabled, out-of-band data is placed in the normal data input queue as it is received. It is then made available to SockRecv() and SockRecvFrom() without the MSG_OOB flag being specified in those calls. If this option is disabled, out-of-band data is placed in the priority data input queue as it is received. It can then only be made available to SockRecv() and SockRecvFrom() by specifying the MSG_OOB flag in those calls.

SO_RCVBUF

sets the buffer size for input. This option sets the size of the receive buffer to the value contained in the buffer pointed to by optval. In this way, the buffer size can be tailored for specific application needs, such as increasing the buffer size for high-volume connections.

SO_RCVLOWAT

sets the receive low-water mark.

SO_RCVTIMEO

sets the timeout value for a receive operation.

SO_REUSEADDR

enables stream and datagram sockets to reuse local addresses. Local addresses that are already in use can then be bound. This alters the normal algorithm used in the SockBind() call. At connection time, the system checks whether the local addresses and ports differ from foreign addresses and ports. If not, the error value EADDRINUSE is returned.

SO_SNDBUF

Sets the buffer size for output. This option sets the size of the send buffer to the value contained in the buffer pointed to by optval. In this way, the send buffer size can be tailored for specific application needs, such as increasing the buffer size for high-volume connections.

SO_SNDLOWAT

sets the send low-water mark. This mark is ignored for nonblocking calls and not used in the Internet domain.

SO_SNDTIMEO

sets the timeout value for a send operation.

SO_USELOOPBACK

bypasses hardware where possible.

Except for SO_LINGER, all values are integral. SO_LINGER expects two blank delimited integers:

1. The l_onoff value. It is set to 0 if the SO_LINGER option is disabled.
2. the l_linger value. The l_linger field specifies the amount of time, in seconds, to be lingered on close. A value of 0 causes SockSoClose() to wait until disconnection completes.

Return values:

The value 0 indicates successful execution of the call. The value -1 indicates an error. You can get the specific error code SockSock_Errno() or SockPSock_Errno(). Possible values are:

EADDRINUSE

The address is already in use.

ENOTSOCK

socket is not a valid socket descriptor.

ENOPROTOOPT

optname is not recognized.

EINVAL

Invalid argument.

ENOBUFS

There is no buffer space available.

Note: SockSetSockOpt() interfaces with the C function setsockopt().

5.24. SockShutDown

The SockShutDown() call shuts down all, or part, of a full duplex connection. This call is optional.

Syntax:

```
>>--SockShutDown(socket, howto)-----------------------------------------><
```

>where:

socket

is the socket descriptor.

howto

is the condition of the shutdown of socket.

Because data flows in different directions are independent of each other, SockShutDown() allows you to independently stop data flows in one direction, or all data flows, with one API call. For example, you can enable yourself to send data but disable other senders to send data to you.

The howto parameter sets the condition for shutting down the connection to socket socket. It can be set to one of the following:

0

No more data can be received on socket.

1

No more output is allowed on socket.

2

No more data can be sent or received on socket.

Return values:

The value 0 indicates successful execution of the call. The value -1 indicates an error. You can get the specific error code SockSock_Errno() or SockPSock_Errno(). Possible values are:

ENOTSOCK

socket is not a valid socket descriptor.

EINVAL

howto was not set to a valid value.

Note: SockShutDown() interfaces with the C function shutdown().

5.25. SockSock_Errno

The SockSock_Errno() call returns the last error code set by a socket call. Subsequent socket API calls do not reset this error code.

Syntax:

```
>>--SockSock_Errno()-----------------------------------------------------><
```

Note: SockSock_Errno() interfaces with the C function sock_errno().

5.26. SockSocket

The SockSocket() call creates an end point for communication and returns a socket descriptor representing the end point. Each socket type provides a different communication service.

Syntax:

```
>>--SockSocket(domain, type, protocol)----------------------------------><
```

where:

domain

is the communication domain requested. It specifies the protocol family to be used. Currently, only the domain AF_INET is supported, which uses addresses in the Internet address format.

type

is the type of socket created. The following types are supported:

SOCK_STREAM

provides sequenced, two-way byte streams that are reliable and connection-oriented. It supports a mechanism for out-of-band data. Stream sockets are supported by the Internet (AF_INET) communication domain.

SOCK_DGRAM

provides datagrams, which are connectionless messages of a fixed length whose reliability is not guaranteed. Datagrams can be received out of order, lost, or delivered several times. Datagram sockets are supported by the Internet (AF_INET) communication domain.

SOCK_RAW

provides the interface to internal protocols, such as IP and ICMP. Raw sockets are supported by the Internet (AF_INET) communication domain.

protocol

is the protocol to be used with the socket. It can be IPPROTO_UDP, IPPROTO_TCP, or 0. If it is set to 0, which is the default, the system selects the default protocol number for the domain and socket type requested.

Sockets are deallocated with the SockClose() call.

Return values:

A non-negative socket descriptor return value indicates successful execution of the call. The return value -1 indicates an error. You can get the specific error code SockSock_Errno() or SockPSock_Errno(). Possible values are:

EMFILE

The maximum number of sockets are currently in use.

EPROTONOSUPPORT

The protocol is not supported in the specified domain or the protocol is not supported for the specified socket type.

EPFNOSUPPORT

The protocol family is not supported.

ESOCKTNOSUPPORT

The socket type is not supported.

Note: SockSocket() interfaces with the C function socket().

5.27. SockSoClose

The SockSoClose() call shuts down a socket and frees resources allocated to the socket.

Syntax:

```
>>--SockSoClose(socket)-------------------------------------------------><
```

where:

socket

is the socket descriptor of the socket to be closed.

This function is identical to SockClose().

Chapter 6. Socket Class Reference

The following sections describe the socket class supplied with ooRexx. This class encapsulates the rxsock external functions into several classes that improve the functionality if the external function library by extending the error checking and reducing the amount of code needed in an average rxsock program.

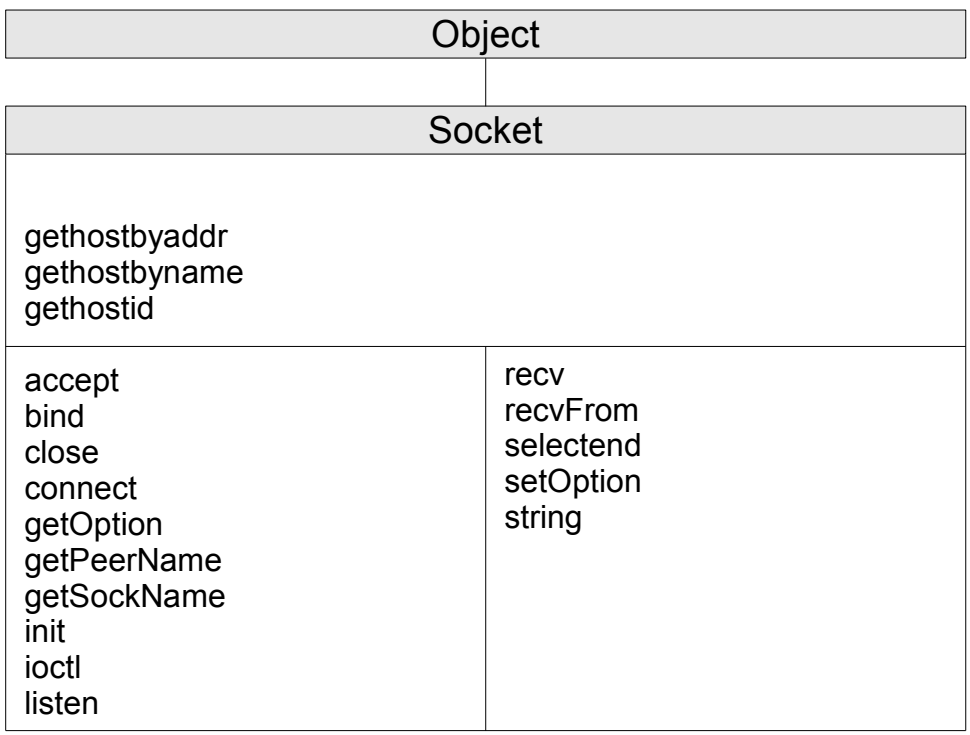
6.1. Installation

The Socket class package is contained in the file socket.cls. This file must be placed in a directory listed in your PATH. To get access to the class and methods in the Socket class, include the following statement in your Rexx program:

```
::requires 'socket.cls'
```

6.2. The Socket Class

Figure 6-1. The Socket Class



6.2.1. getHostByAddr (class) method

```
>>--getHostByAddr(ipaddr)-------------------------------------><
```

This is a class method. It returns an instance of the HostInfo class.

6.2.2. getHostByName (class) method

```
>>--getHostByName(hostname)-----------------------------------><
```

This is a class method. It returns an instance of the HostInfo class.

6.2.3. getHostId (class) method

```
>>--getHostId()-----------------------------------------------><
```

This is a class method. It returns the dotted decimal host id of the local machine.

6.2.4. accept method

```
>>--accept()-------------------------------------------------><
```

This method returns a new socket class instance that is connected to a remote host that has requested a connection from a server socket.

6.2.5. bind method

```
>>--bind(address)--------------------------------------------><
```

This method binds a socket to a particular local ip address specified by an instance of the InetAddress class contained in the *address* argument.

6.2.6. close method

```
>>--close()--------------------------------------------------><
```

This method closes this socket instance.

6.2.7. connect method

```
>>--connect(address)-----------------------------------------><
```

This method connect the socket to a remote address specified by an instance of the InetAddress class contained in the *address* argument.

6.2.8. getOption method

```
>>--getOption(option)-----------------------------------------><
```

This method returns the value of the options specified by the *option* argument.

The *option* argument must be one of the following:

SO_BROADCAST
SO_DEBUG
SO_DONTROUTE
SO_ERROR
SO_KEEPALIVE
SO_LINGER
SO_OOBINLINE
SO_RCVBUF
SO_RCVLOWAT
SO_RCVTIMEO
SO_REUSEADDR
SO_SNDBUF
SO_SNDLOWAT
SO_SNDTIMEO
SO_TYPE
SO_USELOOPBACK

6.2.9. getPeerName method

```
>>--getPeerName()---------------------------------------------><
```

This method returns the peer name of the remote connection.

6.2.10. getSockName method

```
>>--getSockName()---------------------------------------------><
```

This method returns an instance of the InetAddress class than is the name information of the remote machine.

6.2.11. new (class) method

```
>>--new(--+---------------------------------------+--)------><
          +--domain--+--------------------------+--+
                     +--, type--+--------------+--+
                                +--, protocol--+
```

This method returns a new instance of the Socket.

domain

If specified, this argument must be AF_INET.

type

If specified, this argument must be SOCK_STREAM, SOCK_DGRAM or SOCK_RAW. SOCK_STREAM is the default.

protocol

If specified, this argument must be 0, IPPROTO_UDP or IPPROTO_TCP. 0 is the default.

6.2.12. ioctl method

```
>>--ioctl(cmd, data)-------------------------------------------><
```

This method sends a special command to the socket. The *cmd* and the *data* are not checked for valid values.

6.2.13. listen method

```
>>--listen(backlog)--------------------------------------------><
```

This method turns the socket into a server listening socket. The *backlog* is the number of connection requests the socket should cache.

6.2.14. recv method

```
>>--recv(length)-----------------------------------------------><
```

This method recieves data on a socket connection. The *length* is the maximum number of bytes the socket should receive. This method returns the data received, which could be less than the maximum length specified.

6.2.15. recvFrom method

```
>>--recv(length, address)--------------------------------------><
```

This method recieves data on a socket connection from the specified *address*. The *address* must be an instance of the InetAddress class. The *length* is the maximum number of bytes the socket should receive. This method returns the data received, which could be less than the maximum length specified.

6.2.16. select method

```
>>--select(reads, writes, excepts, timeout)--------------------><
```

This method monitors activity on a set of sockets. It returns the number of sockets ready for activity. Upon return the input argument arrays will be reset to only the sockets that are ready.

reads

An array of socket instances to monitor for read activity.

writes

An array of socket instances to monitor for write activity.

excepts

An array of socket instances to monitor for exception activity.

timeout

The timeout in seconds. This must be a whole number (no fractions allowed).

6.2.17. Send method

```
>>--send(data)-------------------------------------------------><
```

This method sends the *data* on the socket. It returns the number of bytes sent, which could be less than the length of *data*.

6.2.18. setOption method

```
>>--setOption(name, value)-------------------------------------><
```

This method sets the option given by *name* with the data in *value*. See the method getOption for the list of valid *name*s.

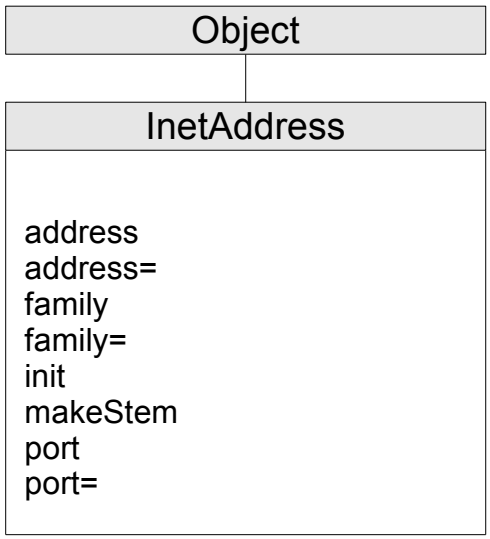
6.2.19. string method

```
>>--string()---------------------------------------------------><
```

This method returns the string representing the socket.

6.3. The InetAddress Class

Figure 6-2. The InetAddress Class



6.3.1. address method

```
>>--address()-------------------------------------------------><
```

This method returns the ip address of the original hostname.

6.3.2. address= method

```
>>--address(ipaddress)----------------------------------------><
```

6.3.2.1. family method)

```
>>--family()--------------------------------------------------><
```

This method returns the ip address family of the original hostname.

6.3.2.2. family= method

```
>>--family(newfamily)-----------------------------------------><
```

This method sets the ip address family of the original hostname.

6.3.2.3. init method

```
>>--init(hostname, port +------------+--)---------------------><
                        +--, family--+
```

This method creates a new instance of the InetAddress class.

hostname

The ip address or host name of the host machine.

port

The port number of the connection.

family

The address family. The only valid value is AF_INET.

6.3.2.4. makeStem method

```
>>--makeStem()-------------------------------------------------><
```

This method returns a stem variable set to the current values of the instance. This method has limited usefulness to the programmer.

6.3.2.5. port method

```
>>--port()-----------------------------------------------------><
```

This method returns port number of the original hostname.

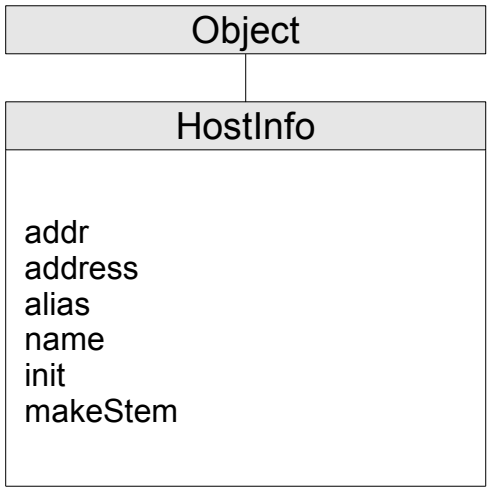
6.3.2.6. port= method

```
>>--port(newport)----------------------------------------------><
```

This method sets the port number of the original hostname.

6.3.3. The HostInfo Class

Figure 6-3. The HostInfo Class



6.3.3.1. addr method

```
>>--addr()-------------------------------------------------------><
```

This method returns an array of ip addresses of the host.

6.3.3.2. address method

```
>>--address()----------------------------------------------------><
```

This method returns the main ip address of the host.

6.3.3.3. alias method

```
>>--alias()------------------------------------------------------><
```

This method returns an array of alias host name of the host.

6.3.3.4. name method

```
>>--alias()------------------------------------------------------><
```

This method returns the main host name of the host.

6.3.3.5. init method

```
>>--init(hostname)-------------------------------------------><
```

This method create an instance of the HostInfo class and sets all the attribute methods of the instance. The *hostname* can be either a valid DNS host name or an ip address.

6.3.3.6. makeStem method

```
>>--makeStem()-----------------------------------------------><
```

This method returns a stem variable set to the current values of the instance. This method has limited usefulness to the programmer.

6.4. Socket Class Example

```
host = '127.0.0.1'
port = 8080
srvr = .server~new(host, port)
call syssleep(1) -- just to let the server get started
call client host, port, 'This is test 1'
call client host, port, 'This is test 2'
call client host, port, 'stop'
return

::requires 'socket.cls'

::routine client
use strict arg host, port, message
-- get a new socket
s = .socket~new()
-- set the server address/port to connection information
addr = .inetaddress~new(host, port)
-- connect to the server
retc = s~connect(addr)
if retc &lt;&gt; 0 then do
   say 'Error' s~errno() 'connecting to server socket.'
   return
   end
-- send the command
retc = s~send(message)
-- receive the command back
say s~recv(4096)
-- close the socket
s~close()
return

::class server
```

```
::method init
use strict arg host, port
-- get a new socket
s = .socket~new()
if s = -1 then do
   say 'Error' s~errno() 'creating server socket'
   return
   end
-- set the socket to reuse the addresses assigned to it
retc = s~setoption('SO_REUSEADDR', 1)
if retc = -1 then do
   say 'Error' s~errno() 'setting socket option'
   return
   end
-- bind the socket to an address/port
addr = .inetaddress~new(host, port)
retc = s~bind(addr)
if retc = -1 then do
   say 'Error' s~errno() 'binding socket'
   return
   end
-- mark it as a listening socket
retc = s~listen(3)
if retc = -1 then do
   say 'Error' s~errno() 'making the socket a listening socket'
   return
   end
say 'Server starting'
reply
stop = .false
do while \stop
   -- accept a client connection socket
   cs = s~accept()
   if cs = .nil then do
      say 'Error accepting new socket'
      iterate
      end
   -- receive the command from the client
   cmd = cs~recv(4096)
   -- echo the command back to the client
   cs~send(cmd)
   -- close the client connection socket
   cs~close()
   -- if the command was stop then stop the server
   if cmd~upper() = 'STOP' then do
      stop = .true
      end
   end
-- close the socket
s~close()
return
```

Chapter 7. StreamSocket Class Reference

The following sections describe the streamsocket class supplied with ooRexx. This class encapsulates the rxsock external functions into a class that treats the socket as a standard ooRexx input/output stream. It improves error checking and reduces the amount of code needed in an average rxsock program.

7.1. Installation

The StreamSocket class package is contained in the file streamsocket.cls. This file must be placed in a directory listed in your PATH. To get access to the class and methods in the StreamSocket class, include the following statement in your Rexx program:

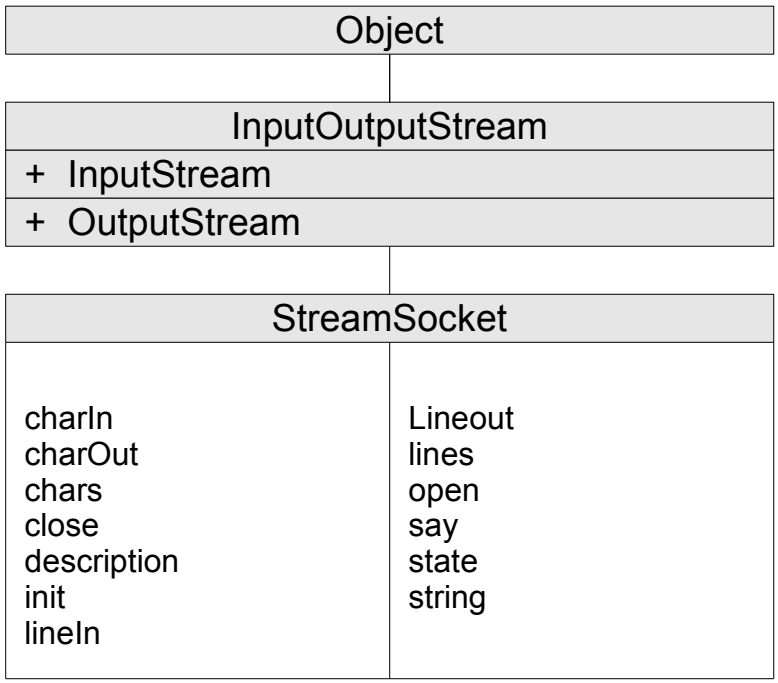
```
::requires 'streamsocket.cls'
```

7.2. The StreamSocket Class

A streamsocket object allows external communication from Rexx to a socket.

The StreamSocket class is a subclass of the InputOutputStream class.

Figure 7-1. The StreamSocket class and methods



Note: The StreamSocket class also has available class methods that its metaclass, the Class class, defines. It also inherits methods from the InputOutputStream class.

7.2.1. Inherited Methods

Methods inherited from the InputStream class.

Note: This class is searched second for inherited methods.

arrayIn	close	open
charIn	lineIn	position
charOut	lineOut	
chars	lines	

Methods inherited from the OutputStream class.

Note: This class is searched first for inherited methods.

arrayOut	close	open
charIn	lineIn	position
charOut	lineOut	
chars	lines	

7.2.2. new (Inherited Class Method)

```
>>-new(host, port--+-------------+--)-------------------------><
                   +--, bufsize--+
```

Initializes a stream object for the *host* and *port*, but does not open the stream. Returns the new stream object.

host

The host name or TCP/IP address of an Internet host.

port

The port number of the host.

bufsize

(optional) The buffersize to use for read operations. The default size is 4096.

7.2.3. arrayIn

This method is invalid for this class and will raise an error if invoked.

7.2.4. arrayOut

This method is invalid for this class and will raise an error if invoked.

7.2.5. charIn

```
>>-charIn-+---------------------------+----------------------><
          +-(-+-------+--+---------+-)-+
              +-start-+  +-,length-+
```

Returns a string of up to *length* characters from the input stream. If you omit *length*, it defaults to `1`. If you specify *start*, it will be ignored since sockets are considered not to be persistent streams. If the stream is not already open, the stream attempts to open for reading and writing. If that fails, the stream opens for input only.

7.2.6. charOut

```
>>-charOut-+--------------------------+--------------------><
           +-(-+--------+--+--------+-)-+
               +-string-+  +-,start-+
```

Returns the count of characters remaining after trying to write *string* to the output stream.

The *string* can be the null string. In this case, **charOut** writes no characters to the stream and returns `0`. If you omit *string*, **charOut** writes no characters to the stream and returns `0`.

If you specify *start* it will be ignored since socket streams are not considered persistent.

7.2.7. chars

```
>>-chars-----------------------------------------------------><
```

Returns `1` if the stream is open. Otherwise returns`0`.

7.2.8. close

```
>>-close-----------------------------------------------------><
```

Closes the stream. **close** returns `READY:` if closing the stream is successful, or an appropriate error message. If you have tried to close an unopened socket, then the **close** method returns a null string ("").

7.2.9. description

```
>>-description-----------------------------------------------><
```

Returns any descriptive string associated with the current state of the stream or the Nil object if no descriptive string is available. The **description** method is identical with the STATE method except that the string that **description** returns is followed by a colon and, if available, additional information about ERROR or NOTREADY states. (The state method describes these states.)

7.2.10. lineIn

```
>>-lineIn-+-------------------------+-------------------------><
          +-(-+------+-+--------+-)-+
              +-line-+ +-,count-+
```

Returns the next *count* lines. The count must be `0` or `1`. If you omit *count*, it defaults to `1`. A *line* number may be given but it will be ignored since sockets are not considered to be a persistent stream. If the stream is not already open, the it tries to open the stream for reading and writing.

7.2.11. lineOut

```
>>-lineOut-+------------------------+----------------------><
           +-(-+--------+-+-------+-)-+
               +-string-+ +-,line-+
```

Returns `0` if successful in writing *string* to the output stream or `1` if an error occurs while writing the line. If you specify *line* it will be ignored since a socket is not considered to be a persistent stream.

7.2.12. lines

```
>>-lines-----------------------------------------------------><
```

Returns `1` if the stream is open. Otherwise returns`0`.

7.2.13. open

```
>>-open------------------------------------------------------><
```

Opens the stream for input and output and returns `READY:`. If the method is unsuccessful, it returns an error message string in the same form that the **description** method uses.

For most error conditions, the additional information is in the form of a numeric return code. This return code is the value of `ERRNO`, which is set whenever one of the file system primitives returns with a `-1`.

7.2.14. position

```
>>-position--------------------------------------------------><
```

This method is invalid for this class and will raise an error if invoked.

7.2.15. say

```
>>-say--+---------------+-------------------------------------><
        +-(-+--------+-)-+
            +-string-+
```

Returns `0` if successful in writing *string* to the output stream or `1` if an error occurs while writing the line.

7.2.16. state

```
>>-state-----------------------------------------------------><
```

Returns a string indicating the current stream state.

The returned strings are as follows:

ERROR

The stream has been subject to an erroneous operation (possibly during input or output. You might be able to obtain additional information about the error with the **description** method.

NOTREADY

The stream is known to be in such a state that the usual input or output operations attempted upon would raise the NOTREADY condition.

READY

The stream is known to be in such a state that the usual input or output operations might be attempted. This is the usual state for a stream, although it does not guarantee that any particular operation will succeed.

UNKNOWN

The state of the stream is unknown. This generally means that the stream is closed or has not yet been opened.

7.2.17. string

```
>>-string-----------------------------------------------------><
```

Returns a string that indicates the name of the object the stream represents i.e. the `hostname:port`.

Chapter 8. SMTP Class Reference

The following sections describe the smtp class supplied with ooRexx. This class can send SMTP messages to an SMTP server. It utilizes the StreamSocket class to perform the communications with the server.

8.1. Installation

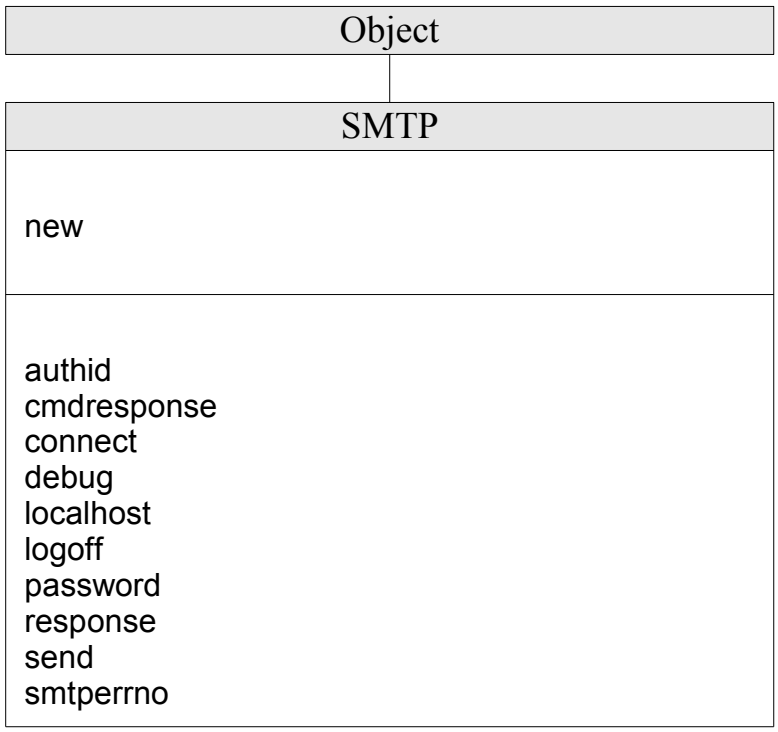
The SMTP class package is contained in the file smtp.cls. This file must be placed in a directory listed in your PATH. To get access to the class and methods in the SMTP class, include the following statement in your Rexx program:

```
::requires 'smtp.cls'
```

8.2. The SMTP Class

This class encapsulates all the communications necessary to send mail via an SMTP server.

Figure 8-1. The SMTP class and methods



Note: The SMTP class also has available class methods that its metaclass, the Class class, defines.

8.2.1. new (Class Method)

```
>>-new-------------------------------------------------------><
```

Initializes the object. Returns the new smtp object.

8.2.2. authid

```
>>-authid()--------------------------------------------------><

>>-authid(newauthid)------------------------------------------><
```

This method either sets the authid or returns the current authid. The default value for the authid is a zero-length string.

8.2.3. cmdrespomse

```
>>-cmdresponse-------------------------------------------------><
```

This method returns an array containing all the commands sent to the SMTP server and the responses from that server.

8.2.4. connect

```
>>-connect(smtphost--+-------------------------------+--)------->>
                     +--, authid-----+--------------+-+
                                     +--, password--+
```

This opens the connection to the SMTP host machine.

smtphost

The host name or TCP/IP address of the SMTP host. This string can contain a port designation.

authid

(Optional) The account authid to be used if needed.

password

(optional) The password for the specified authid.

8.2.5. debug

```
>>-debug-----------------------------------------------------><

>>-debug(flag)------------------------------------------------><
```

This method either sets the debug flag or returns the current flag value. The default value for the flag is 0 (false) which suppresses debug messages.

8.2.6. localhost

```
>>-localhost-------------------------------------------------><
```

This method returns the local host name.

8.2.7. logoff

```
>>-logoff----------------------------------------------------><
```

This method logs off the session to the SMTP host.

8.2.8. password

```
>>-password-------------------------------------------------><

>>-password(newpassword)------------------------------------><
```

This method either sets the smtp server account passwordor returns the password value. The default value for the password is a zero-length string.

8.2.9. response

```
>>-response-------------------------------------------------><
```

This method returns the parsed response to the last command sent to the SMTP server. The initial value for the repsonse is a zero-length string.

8.2.10. send

```
>>-send(msg)------------------------------------------------><
```

This method sends an SMTP message to the SMTP server. The *msg* must be an instance of the SMTPMsg class.

8.2.11. smtperrno

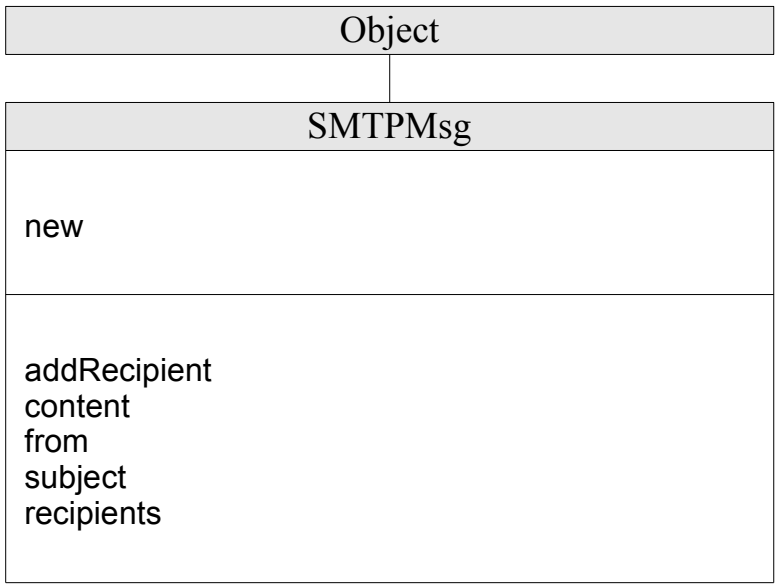
```
>>-smtperrno------------------------------------------------><
```

This method returns the return code of the last command sent to the SMTP server. The initial value for the repsonse is a zero-length string.

8.3. The SMTPMsg Class

This class encapsulates all information needed to communicate a complete message to the SMTP server.

Figure 8-2. The SMTPMsg class and methods



Note: The SMTPMsg class also has available class methods that its metaclass, the Class class, defines.

8.3.1. new (Class Method)

```
>>-new-------------------------------------------------------><
```

Initializes the object. Returns the new smtpmsg object.

8.3.2. addRecipient

```
>>-addRecipient(recp)----------------------------------------><
```

This method adds a new recipient of the message.

8.3.3. content

```
>>-content---------------------------------------------------><

>>-content(part)---------------------------------------------><
```

This method sets a piece of the SMTP message. The *part* must be an instance of the MimePart class, MimeMultiPart class or a plain string.

8.3.4. from

```
>>-from-------------------------------------------------------><
```

```
>>-from(fromaddress)-------------------------------------------><
```

This method sets or fetches the "From" mail header field.

8.3.5. recipients

```
>>-recipients--------------------------------------------------><
```

This returns an array of the mail header "Recipient" fields.

8.3.6. subject

```
>>-subject-----------------------------------------------------><
```

```
>>-subject(newsubject)-----------------------------------------><
```

This method sets or fetches the "Subject" mail header field.

Chapter 9. Mime Classes Reference

The following sections describe the mime classes supplied with ooRexx. These classes encapsulates a mime object. This is most useful for sending complicated email messages vie the SMTP class.

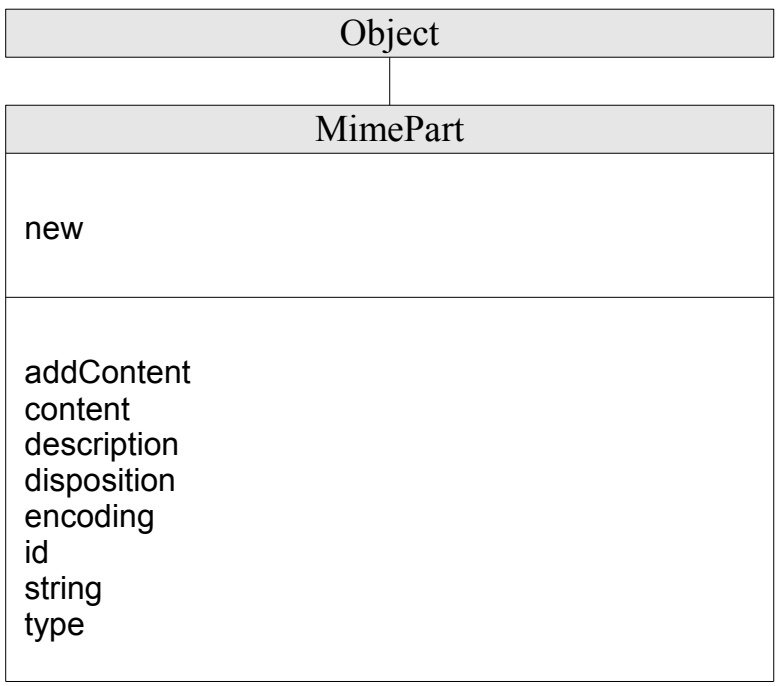
9.1. Installation

The Mime class package is contained in the file mime.cls. This file must be placed in a directory listed in your PATH. To get access to the class and methods in the Mime class, include the following statement in your Rexx program:

```
::requires 'mime.cls'
```

9.2. The MimePart Class

Figure 9-1. The MimePart class and methods



Note: The MimePart class also has available class methods that its metaclass, the Class class, defines.

9.2.1. New (class) method

```
>>--new(--+--------+--)-----------------------------------------><
          +--type--+
```

This is a class method. It returns an instance of the MimePart class.

type

(Optional) The mime type string. The default if not given is "text/plain".

9.2.2. addContent method

```
>>--addContent(string)-------------------------------------------><
```

This method adds content to the mime-content field. This filed may only contain ASCII strings.

string

The ASCII string to be added to the content.

9.2.3. content method

```
>>--content------------------------------------------------------><
```

This method returns the mime-content string.

9.2.4. description method

```
>>--description--------------------------------------------------><

>>--description(newdescription)---------------------------------><
```

This method sets or returns the mime-description string.

newdescription

The mime-description string.

9.2.5. disposition method

```
>>--disposition--------------------------------------------------><
```

```
>>--disposition(newdisposition)-------------------------------><
```

This method sets or returns the mime-disposition string.

newdisposition

The mime-disposition string.

9.2.6. encoding method

```
>>--encoding---------------------------------------------------><

>>--encoding(newencoding)--------------------------------------><
```

This method sets or returns the mime-encoding string.

newencoding

The mime-encoding string.

9.2.7. id method

```
>>--id---------------------------------------------------------><

>>--id(newid)--------------------------------------------------><
```

This method sets or returns the mime-id string.

newid

The mime-id string.

9.2.8. string method

```
>>--string-----------------------------------------------------><
```

This method returns the formatted mime part string.

9.2.9. type method

```
>>--type-------------------------------------------------------><

>>--type(newtype)----------------------------------------------><
```

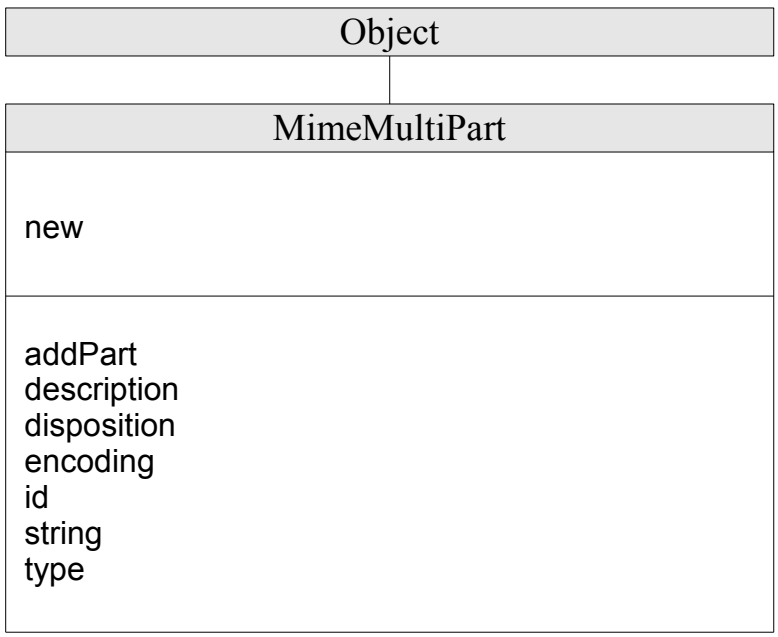
This method sets or returns the mime-type string.

newtype

The mime-type string.

9.3. The MimeMultiPart Class

Figure 9-2. The MimeMultiPart class and methods



Note: The MimeMultiPart class also has available class methods that its metaclass, the Class class, defines.

9.3.1. New (class) method

```
>>--new(--+--------+--)---------------------------------------><
          +--type--+
```

This is a class method. It returns an instance of the MimeMultiPart class.

type

(Optional) The mime type string. The default if not given is "multipart/mixed".

9.3.2. addPart method

```
>>--addPart(part)-----------------------------------------><
```

This method adds a new part to the mime object. *part* must be a

part

The part to be added. The *part* must be an instance of the MimePart class.

9.3.3. description method

```
>>--description-------------------------------------------><
```

```
>>--description(newdescription)--------------------------><
```

This method sets or returns the mime-description string.

newdescription

The mime-description string.

9.3.4. disposition method

```
>>--disposition-------------------------------------------><
```

```
>>--disposition(newdisposition)--------------------------><
```

This method sets or returns the mime-disposition string.

newdisposition

The mime-disposition string.

9.3.5. encoding method

```
>>--encoding----------------------------------------------><
```

```
>>--encoding(newencoding)--------------------------------><
```

This method sets or returns the mime-encoding string.

newencoding

The mime-encoding string.

9.3.6. id method

```
>>--id-------------------------------------------------------><

>>--id(newid)-------------------------------------------------><
```

This method sets or returns the mime-id string.

newid

The mime-id string.

9.3.7. string method

```
>>--string---------------------------------------------------><
```

This method returns the formatted mime part string.

9.3.8. type method

```
>>--type-----------------------------------------------------><

>>--type(newtype)---------------------------------------------><
```

This method sets or returns the mime-type string.

newtype

The mime-type string.

Appendix A. Notices

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    a. changes to the Program, and

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