

echoserver

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# Chapter 1

## Data Structure Index

### 1.1 Data Structures

Here are the data structures with brief descriptions:

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## Chapter 2

# File Index

### 2.1 File List

Here is a list of all files with brief descriptions:

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## Chapter 3

# Data Structure Documentation

### 3.1 ThreadCount Struct Reference

Struct to synchronize access to the active thread count.

#### Data Fields

- pthread\_mutex\_t [mutex](#)
- int [count](#)

#### 3.1.1 Detailed Description

Struct to synchronize access to the active thread count.

#### 3.1.2 Field Documentation

##### 3.1.2.1 int ThreadCount::count

Active thread count variable

##### 3.1.2.2 pthread\_mutex\_t ThreadCount::mutex

Mutex for synchronized access

The documentation for this struct was generated from the following file:

- [debug\\_thread\\_counter.c](#)



## Chapter 4

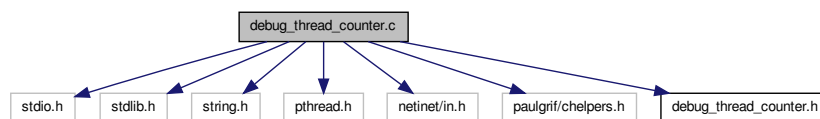
# File Documentation

### 4.1 debug\_thread\_counter.c File Reference

Implementation of debug thread counter.

```
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include <pthread.h>
#include <netinet/in.h>
#include <paulgrif/chelpers.h>
#include "debug_thread_counter.h"
```

Include dependency graph for debug\_thread\_counter.c:



### Data Structures

- struct [ThreadCount](#)  
*Struct to synchronize access to the active thread count.*

### Typedefs

- typedef struct [ThreadCount](#) [ThreadCount](#)  
*Struct to synchronize access to the active thread count.*

### Functions

- int [get\\_thread\\_count](#) (void)  
*Gets the active thread count.*
- void [increment\\_thread\\_count](#) (void)  
*Increments the active thread count.*

- void `decrement_thread_count` (void)  
*Decrements the active thread count.*

## Variables

- static `ThreadCount thread_count` = {PTHREAD\_MUTEX\_INITIALIZER, 0}  
*File scope variable holding the active thread count.*

### 4.1.1 Detailed Description

Implementation of debug thread counter.

#### Author

Paul Griffiths

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### 4.1.2 Typedef Documentation

#### 4.1.2.1 typedef struct ThreadCount ThreadCount

Struct to synchronize access to the active thread count.

### 4.1.3 Function Documentation

#### 4.1.3.1 void decrement\_thread\_count ( void )

Decrements the active thread count.

Used for debugging purposes to check that threads are exiting and being destroyed when expected.

#### 4.1.3.2 int get\_thread\_count ( void )

Gets the active thread count.

Used for debugging purposes to check that threads are exiting and being destroyed when expected.

#### Returns

The number of active threads (excluding the main thread).

#### 4.1.3.3 void increment\_thread\_count ( void )

Increments the active thread count.

Used for debugging purposes to check that threads are exiting and being destroyed when expected.

### 4.1.4 Variable Documentation

#### 4.1.4.1 ThreadCount thread\_count = {PTHREAD\_MUTEX\_INITIALIZER, 0} [static]

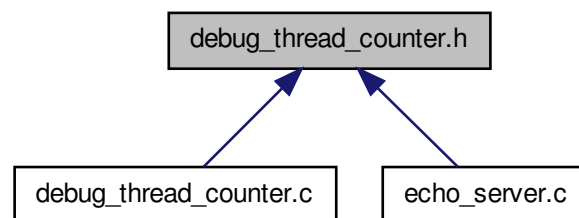
File scope variable holding the active thread count.

This variable is accessed and manipulated solely through the [get\\_thread\\_count\(\)](#), [increment\\_thread\\_count\(\)](#), and [decrement\\_thread\\_count\(\)](#) functions.

## 4.2 debug\_thread\_counter.h File Reference

Interface to debug thread counter.

This graph shows which files directly or indirectly include this file:



### Macros

- `#define DINCREMENT_THREAD_COUNT(arg) increment_thread_count()`  
*Calls [increment\\_thread\\_count\(\)](#) only if `DEBUG` is defined.*
- `#define DDECREMENT_THREAD_COUNT(arg) decrement_thread_count()`  
*Calls [decrement\\_thread\\_count\(\)](#) only if `DEBUG` is defined.*

### Functions

- void [increment\\_thread\\_count](#) (void)  
*Increments the active thread count.*
- void [decrement\\_thread\\_count](#) (void)  
*Decrements the active thread count.*
- int [get\\_thread\\_count](#) (void)  
*Gets the active thread count.*

#### 4.2.1 Detailed Description

Interface to debug thread counter. A utility for counting active threads for debugging purposes.

#### Author

Paul Griffiths

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## 4.2.2 Macro Definition Documentation

### 4.2.2.1 `#define DDECREMENT_THREAD_COUNT( arg ) decrement_thread_count()`

Calls `decrement_thread_count()` only if `DEBUG` is defined.

### 4.2.2.2 `#define DINCREMENT_THREAD_COUNT( arg ) increment_thread_count()`

Calls `increment_thread_count()` only if `DEBUG` is defined.

## 4.2.3 Function Documentation

### 4.2.3.1 `void decrement_thread_count ( void )`

Decrements the active thread count.

Used for debugging purposes to check that threads are exiting and being destroyed when expected.

### 4.2.3.2 `int get_thread_count ( void )`

Gets the active thread count.

Used for debugging purposes to check that threads are exiting and being destroyed when expected.

## Returns

The number of active threads (excluding the main thread).

### 4.2.3.3 `void increment_thread_count ( void )`

Increments the active thread count.

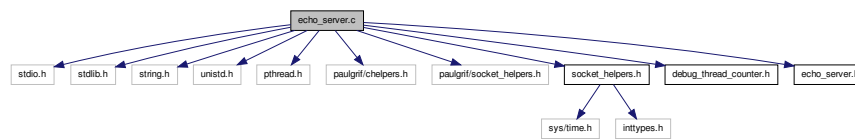
Used for debugging purposes to check that threads are exiting and being destroyed when expected.

## 4.3 `echo_server.c` File Reference

Implementation of echo server functions.

```
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include <unistd.h>
#include <pthread.h>
#include <paulgrif/chelpers.h>
#include <paulgrif/socket_helpers.h>
#include "socket_helpers.h"
#include "debug_thread_counter.h"
#include "echo_server.h"
```

Include dependency graph for echo\_server.c:



## Macros

- `#define MAX_BUFFER_LEN 1024`  
*Maximum character buffer size.*

## Functions

- `void * echo_server (void *arg)`  
*Main echo server handler thread function.*

## Variables

- static const long `time_out_secs` = 60  
*File scope variable for default time out seconds.*
- static const long `time_out_usecs` = 0  
*File scope variable for default time out microseconds.*
- static const char `time_out_msg []` = "Timeout - closing connection.\n"  
*File scope variable for timeout message.*

### 4.3.1 Detailed Description

Implementation of echo server functions.

#### Author

Paul Griffiths

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### 4.3.2 Macro Definition Documentation

#### 4.3.2.1 `#define MAX_BUFFER_LEN 1024`

Maximum character buffer size.

### 4.3.3 Function Documentation

#### 4.3.3.1 `void* echo_server ( void * arg )`

Main echo server handler thread function.

Provides echo server service to a provided connected socket. The server loops and echoes any whole lines provided. The server will time-out after a pre-defined period, if no input, or if no more input, is received.

##### Parameters

<i>arg</i>	Pointer to a ServerTag struct
------------	-------------------------------

##### Returns

NULL

### 4.3.4 Variable Documentation

#### 4.3.4.1 `const char time_out_msg[] = "Timeout - closing connection.\n"` [static]

File scope variable for timeout message.

#### 4.3.4.2 `const long time_out_secs = 60` [static]

File scope variable for default time out seconds.

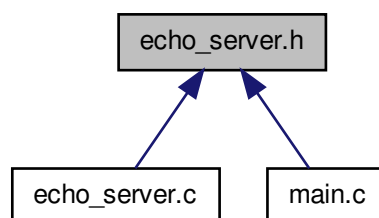
#### 4.3.4.3 `const long time_out_usecs = 0` [static]

File scope variable for default time out microseconds.

## 4.4 echo\_server.h File Reference

Interface to echo server functions.

This graph shows which files directly or indirectly include this file:



## Functions

- `void * echo\_server (void *arg)`



*Main echo server handler thread function.*

### 4.4.1 Detailed Description

Interface to echo server functions.

#### Author

Paul Griffiths

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### 4.4.2 Function Documentation

#### 4.4.2.1 void\* echo\_server ( void \* arg )

Main echo server handler thread function.

Provides echo server service to a provided connected socket. The server loops and echoes any whole lines provided. The server will time-out after a pre-defined period, if no input, or if no more input, is received.

#### Parameters

<i>arg</i>	Pointer to a ServerTag struct
------------	-------------------------------

#### Returns

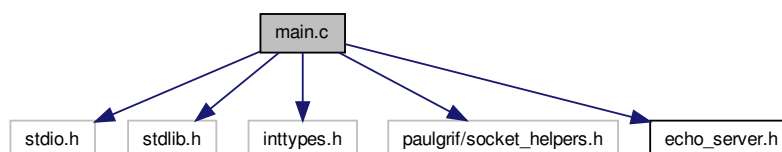
NULL

## 4.5 main.c File Reference

Main function for echoserver.

```
#include <stdio.h>
#include <stdlib.h>
#include <inttypes.h>
#include <paulgrif/socket_helpers.h>
#include "echo_server.h"
```

Include dependency graph for main.c:



## Functions

- `uint16_t get_port_from_commandline` (const int argc, char \*\*argv)  
*Parses the command line for a specified TCP port.*
- `int main` (int argc, char \*\*argv)  
*Main function.*

### 4.5.1 Detailed Description

Main function for echoserver.

#### Author

Paul Griffiths

#### Copyright

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### 4.5.2 Function Documentation

#### 4.5.2.1 `uint16_t get_port_from_commandline` ( const int *argc*, char \*\* *argv* )

Parses the command line for a specified TCP port.

Checks for the existence of a single command line argument, and if one and only one is present, attempts to interpret it as a TCP listening port, between 1 and 49151 (ports above 49151 are ephemeral ports).

#### Parameters

<i>argc</i>	The number of command line arguments, passed from <code>main()</code>
<i>argv</i>	The command line arguments, passed from <code>main()</code>

#### Returns

The specified TCP port if successful, or 0 on error.

#### 4.5.2.2 `int main` ( int *argc*, char \*\* *argv* )

Main function.

Main function.

#### Returns

Exit status.

## 4.6 `socket_helpers.c` File Reference

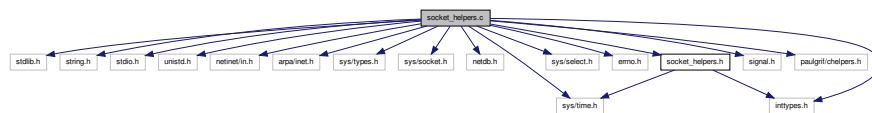
Implementation of socket helper functions.

```

#include <stdlib.h>
#include <string.h>
#include <stdio.h>
#include <unistd.h>
#include <netinet/in.h>
#include <arpa/inet.h>
#include <sys/types.h>
#include <sys/socket.h>
#include <netdb.h>
#include <sys/time.h>
#include <sys/select.h>
#include <errno.h>
#include <inttypes.h>
#include <signal.h>
#include <paulgrif/chelpers.h>
#include "socket_helpers.h"

```

Include dependency graph for socket\_helpers.c:



## Macros

- #define `MAX_BUFFER_SIZE` 1024  
*Maximum character buffer size.*

## Functions

- ssize\_t `socket_readline_r` (const int socket, char \*buffer, const size\_t max\_len, char \*\*error\_msg)  
*Reads a \n terminated line from a socket.*
- ssize\_t `socket_readline_timeout_r` (const int socket, char \*buffer, const size\_t max\_len, struct timeval \*time\_out, char \*\*error\_msg)  
*Reads a \n terminated line from a socket with timeout.*
- ssize\_t `socket_writeline_r` (const int socket, const char \*buffer, const size\_t max\_len, char \*\*error\_msg)  
*Writes a line to a socket.*

### 4.6.1 Detailed Description

Implementation of socket helper functions.

#### Author

Paul Griffiths

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## 4.6.2 Macro Definition Documentation

### 4.6.2.1 `#define MAX_BUFFER_SIZE 1024`

Maximum character buffer size.

## 4.6.3 Function Documentation

### 4.6.3.1 `ssize_t socket_readline_r ( const int socket, char * buffer, const size_t max_len, char ** error_msg )`

Reads a `\n` terminated line from a socket.

The function will not overwrite the buffer, so `max_len` should be the size of the whole buffer, and function will at most write `max_len - 1` characters plus the terminating `\0`. Any terminating CR or LF characters will be stripped.

#### Parameters

<i>socket</i>	File description of the socket
<i>buffer</i>	The buffer into which to read
<i>max_len</i>	The maximum number of characters to read, including the terminating <code>\0</code> .
<i>error_msg</i>	A pointer to a char pointer which may point to an error message on failure. Set this to NULL to avoid setting an error message.

#### Returns

The number of characters read, or -1 on encountering an error.

### 4.6.3.2 `ssize_t socket_readline_timeout_r ( const int socket, char * buffer, const size_t max_len, struct timeval * time_out, char ** error_msg )`

Reads a `\n` terminated line from a socket with timeout.

Behaves the same as `socket_readline()`, except it will time out if no input is available on the socket after the specified time. Any terminating CR or LF characters will be stripped.

#### Parameters

<i>socket</i>	File description of the socket
<i>buffer</i>	The buffer into which to read
<i>max_len</i>	The maximum number of characters to read, including the terminating <code>\0</code> .
<i>time_out</i>	A pointer to a <code>timeval</code> struct containing the timeout period. Note that some implementations of <code>select()</code> may alter this variable, so the calling function should consider it unusable after return. In addition, on such an implementation, the value will specify the cumulative timeout period over the entire read line operation, rather than resetting after reading each character.
<i>error_msg</i>	A pointer to a char pointer which may point to an error message on failure. Set this to NULL to avoid setting an error message.

#### Returns

The number of characters read, or -1 on encountering an error.

### 4.6.3.3 `ssize_t socket_writeline_r ( const int socket, const char * buffer, const size_t max_len, char ** error_msg )`

Writes a line to a socket.

The function adds a network-standard terminating CRLF, so the provided string should not normally end in any newline characters.

## Parameters

<i>socket</i>	File description of the socket
<i>buffer</i>	The buffer from which to write.
<i>max_len</i>	The maximum number of characters to write to the buffer. Due to the addition of CRLF, <code>max_len + 2</code> characters may actually be written.
<i>error_msg</i>	A pointer to a char pointer which may point to an error message on failure. Set this to NULL to avoid setting an error message.

## Returns

The number of characters written, or -1 on encountering an error.

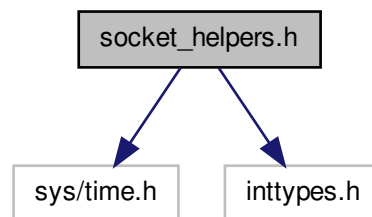
## 4.7 socket\_helpers.h File Reference

Interface to socket helper functions.

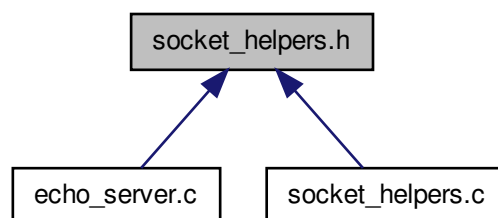
```
#include <sys/time.h>
```

```
#include <inttypes.h>
```

Include dependency graph for socket\_helpers.h:



This graph shows which files directly or indirectly include this file:



## Functions

- `ssize_t` [socket\\_readline\\_r](#) (const int l\_socket, char \*buffer, const size\_t max\_len, char \*\*error\_msg)

*Reads a \n terminated line from a socket.*

- `ssize_t socket_readline_r` (const int `l_socket`, char \*`buffer`, const `size_t` `max_len`, struct `timeval` \*`time_out`, char \*\*`error_msg`)

*Reads a \n terminated line from a socket with timeout.*

- `ssize_t socket_writeline_r` (const int `l_socket`, const char \*`buffer`, const `size_t` `max_len`, char \*\*`error_msg`)

*Writes a line to a socket.*

#### 4.7.1 Detailed Description

Interface to socket helper functions.

##### Author

Paul Griffiths

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#### 4.7.2 Function Documentation

##### 4.7.2.1 `ssize_t socket_readline_r` ( const int `socket`, char \* `buffer`, const `size_t` `max_len`, char \*\* `error_msg` )

Reads a \n terminated line from a socket.

The function will not overwrite the buffer, so `max_len` should be the size of the whole buffer, and function will at most write `max_len - 1` characters plus the terminating \0. Any terminating CR or LF characters will be stripped.

##### Parameters

<code>socket</code>	File description of the socket
<code>buffer</code>	The buffer into which to read
<code>max_len</code>	The maximum number of characters to read, including the terminating \0.
<code>error_msg</code>	A pointer to a char pointer which may point to an error message on failure. Set this to NULL to avoid setting an error message.

##### Returns

The number of characters read, or -1 on encountering an error.

##### 4.7.2.2 `ssize_t socket_readline_timeout_r` ( const int `socket`, char \* `buffer`, const `size_t` `max_len`, struct `timeval` \* `time_out`, char \*\* `error_msg` )

Reads a \n terminated line from a socket with timeout.

Behaves the same as `socket_readline()`, except it will time out if no input is available on the socket after the specified time. Any terminating CR or LF characters will be stripped.

##### Parameters

<code>socket</code>	File description of the socket
<code>buffer</code>	The buffer into which to read
<code>max_len</code>	The maximum number of characters to read, including the terminating \0.

<i>time_out</i>	A pointer to a <code>timeval</code> struct containing the timeout period. Note that some implementations of <code>select()</code> may alter this variable, so the calling function should consider it unusable after return. In addition, on such an implementation, the value will specify the cumulative timeout period over the entire read line operation, rather than resetting after reading each character.
<i>error_msg</i>	A pointer to a char pointer which may point to an error message on failure. Set this to NULL to avoid setting an error message.

**Returns**

The number of characters read, or -1 on encountering an error.

#### 4.7.2.3 `ssize_t socket_writeline_r ( const int socket, const char * buffer, const size_t max_len, char ** error_msg )`

Writes a line to a socket.

The function adds a network-standard terminating CRLF, so the provided string should not normally end in any newline characters.

**Parameters**

<i>socket</i>	File description of the socket
<i>buffer</i>	The buffer from which to write.
<i>max_len</i>	The maximum number of characters to write to the buffer. Due to the addition of CRLF, <code>max_len + 2</code> characters may actually be written.
<i>error_msg</i>	A pointer to a char pointer which may point to an error message on failure. Set this to NULL to avoid setting an error message.

**Returns**

The number of characters written, or -1 on encountering an error.

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