Lab 3 - CE156 - Reliable UDP”

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Here are the data structures with brief descriptions:

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3.1 client_ip_port Struct Reference

Data Fields

- unsigned long ip
- unsigned short port

3.1.1 Field Documentation

3.1.1.1 unsigned long client_ip_port::ip

3.1.1.2 unsigned short client_ip_port::port

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

- server.c

3.2 mftp_packet Struct Reference

My custom protocol packet.

`#include <rudp.h>`

Data Fields

- unsigned int seq
- char data [1024]
- unsigned int flag

3.2.1 Detailed Description

My custom protocol packet.

3.2.2 Field Documentation

3.2.2.1 char mftp_packet::data[1024]

3.2.2.2 unsigned int mftp_packet::flag

3.2.2.3 unsigned int mftp_packet::seq

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

- rudp.h

3.3 threadargs Struct Reference

Data Fields

- unsigned int cnum
- char address [128]
- unsigned int port
- char filename [256]
- unsigned int validipnum

3.3.1 Field Documentation

3.3.1.1 char threadargs::address[128]

3.3.1.2 unsigned int threadargs::cnum

3.3.1.3 char threadargs::filename[256]

3.3.1.4 unsigned int threadargs::port

3.3.1.5 unsigned int threadargs::validipnum

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

- client.c

Chapter 4

File Documentation

4.1 client.c File Reference

```
#include <arpa/inet.h>
#include <errno.h>
#include <netdb.h>
#include <netinet/in.h>
#include <stdlib.h>
#include <stdio.h>
#include <sys/types.h>
#include <sys/socket.h>
#include <time.h>
#include <unistd.h>
#include <string.h>
#include <pthread.h>
#include <sys/stat.h>
#include "utils.h"
#include "rudp.h"
```

Data Structures

- struct threadargs

Macros

- #define SUCCESS 0
- #define FAILURE 1
- #define FALSE 0

Functions

- void check_error (char *x, char *y)
- void * thread_get_chunk (void *arg)
- unsigned char * serialize_threadargs (struct threadargs, unsigned char buffer[])
- struct threadargs deserialize_threadargs (unsigned char buffer[])
- int main (int argc, char **argv)

4.1.1 Macro Definition Documentation

4.1.1.1 #define FAILURE 1

4.1.1.2 #define FALSE 0

4.1.1.3 #define SUCCESS 0

4.1.2 Function Documentation

4.1.2.1 void check_error (char * *x,* char * *y*)

4.1.2.2 struct **threadargs** deserialize_threadargs (unsigned char *buffer[]*) [read]

4.1.2.3 int main (int *argc,* char ** *argv*)

4.1.2.4 unsigned char * serialize_threadargs (struct **threadargs** *p,* unsigned char *buffer[]*)

4.1.2.5 void * thread_get_chunk (void * *arg*)

4.2 rudp.c File Reference

```
#include <stdlib.h>
#include <stdio.h>
#include <unistd.h>
#include <errno.h>
#include <string.h>
#include <stdarg.h>
#include <dirent.h>
#include <sys/stat.h>
#include <sys/socket.h>
#include <netinet/in.h>
#include "rudp.h"
#include "utils.h"
```

Macros

- #define SUCCESS 0
- #define FAILURE 1
- #define TRUE 1
- #define FALSE 0

Functions

- unsigned char * serialize_int (unsigned char *buffer, unsigned int val)

  Serializes an int into a unsigned char.
- unsigned char * serialize_data (unsigned char *buffer, char buf[], int len)

  Serializes an char array into a unsigned char array.
- unsigned char * serialize_packet (mftp_packet packet, unsigned char buffer[])

  Serialize mftp_packet into a buffer.
- unsigned char * deserialize_int (unsigned char *buffer, unsigned int *val)

  Deserializes an int into a unsigned char.
- unsigned char * deserialize_data (unsigned char *buffer, char buf[], int len)

Deserializes an char array into a unsigned char array.

- mftp_packet deserialize_packet (unsigned char buffer[])

  Deserialize buffer into mftp_packet.
- void send_error (int seq, int clisock, const struct sockaddr_in client, int clen)

  Send an error datagram to a socket.
- void send_ack (int seq, int clisock, const struct sockaddr_in client, int clen)

  Send an ack datagram to a socket.
- int send_dgram (int socket, const struct sockaddr_in *cli, int dlen, const mftp_packet data)

  Sends a datagram to a client.
- mftp_packet parse_dgram (unsigned char buffer[])

  Parses incoming datagrams.

4.2.1 Macro Definition Documentation

4.2.1.1 #define FAILURE 1

4.2.1.2 #define FALSE 0

4.2.1.3 #define SUCCESS 0

4.2.1.4 #define TRUE 1

4.2.2 Function Documentation

4.2.2.1 unsigned char* deserialize_data (unsigned char * *buffer*, char *buf[]*, int *len*)

Deserializes an char array into a unsigned char array.

Parameters

buffer	The array to get the data from.
buf	The buffer to save it.
len	Then length of buf.

Returns

A pointer to the next free space in the buffer.

4.2.2.2 unsigned char* deserialize_int (unsigned char * *buffer*, unsigned int * *val*)

Deserializes an int into a unsigned char.

Parameters

buffer	The array to get the data out of.
val	The value to save the data.

Returns

A pointer to the next free space in the buffer.

4.2.2.3 mftp_packet deserialize_packet (unsigned char *buffer[]*)

Deserialize buffer into mftp_packet.

Parameters

buffer	The buffer to get data from.
len	The length of the buffer.

4.2.2.4 mftp_packet parse_dgram (unsigned char *buffer[]*)

Parses incoming datagrams.

runs the deserializer.

Parameters

buffer	The buffer to parse into a mftp struct

Returns

A mftp_packet filled with data.

4.2.2.5 void send_ack (int *sequence_number,* int *clisock,* sockaddr_in *client,* int *clen*)

Send an ack datagram to a socket.

Parameters

sequence_number	The sequence number of the datagram
clisock	The socket to send the data to.
client	The reciever.
clen	The length of the sockaddr_in struct.

4.2.2.6 int send_dgram (int *socket,* const struct sockaddr_in * *cli,* int *dlen,* const mftp_packet *data*)

Sends a datagram to a client.

Parameters

socket	The socket to send to.
cli	the structure with the ip and port to send to.
dlen	length of the stucture cli.
data	The custom packet with data and flags etc.

Returns

Returns 1 if successful and 0 if it fails. Approriate messages are printed to stderr.

4.2.2.7 void send_error (int *sequence_number,* int *clisock,* sockaddr_in *client,* int *clen*)

Send an error datagram to a socket.

Parameters

sequence_number	The sequence number of the datagram
clisock	The socket to send the data to.
client	The reciever.
clen	The length of the sockaddr_in struct.

4.2.2.8 unsigned char* serialize_data (unsigned char * *buffer*, char *buf[]*, int *len*)

Serializes an char array into a unsigned char array.

Parameters

buffer	The array to insert the data.
buf	The value to serialize.
len	Then length of buf.

Returns

A pointer to the next free space in the buffer.

4.2.2.9 unsigned char* serialize_int (unsigned char * *buffer*, unsigned int *val*)

Serializes an int into a unsigned char.

Parameters

buffer	The array to insert the data.
val	The value to serialize.

Returns

A pointer to the next free space in the buffer.

4.2.2.10 unsigned char* serialize_packet (mftp_packet *packet*, unsigned char *buffer[]*)

Serialize mftp_packet into a buffer.

Parameters

packet	The packet to be serialized into a buffer.
buffer	The buffer to fill up/
len	The length of the buffer.

4.3 rudp.h File Reference

Data Structures

- struct mftp_packet

  My custom protocol packet.

Macros

- #define START 1

  Flags for custom packet.
- #define DATA 2
- #define ACK 3
- #define ERROR 4

Typedefs

- typedef struct sockaddr sockaddr
- typedef struct sockaddr_in sockaddr_in
- typedef struct mftp_packet mftp_packet

  My custom protocol packet.
- typedef mftp_packet * mftp_packet_ref

Functions

- unsigned char * serialize_int (unsigned char *buffer, unsigned int val)

  Serializes an int into a unsigned char.
- unsigned char * serialize_data (unsigned char *buffer, char buf[], int len)

  Serializes an char array into a unsigned char array.
- unsigned char * deserialize_int (unsigned char *buffer, unsigned int *val)

  Deserializes an int into a unsigned char.
- unsigned char * deserialize_data (unsigned char *buffer, char buf[], int len)

  Deserializes an char array into a unsigned char array.
- unsigned char * serialize_packet (mftp_packet packet, unsigned char buffer[])

  Serialize mftp_packet into a buffer.
- mftp_packet deserialize_packet (unsigned char buffer[])

  Deserialize buffer into mftp_packet.
- void send_ack (int sequence_number, int clisock, sockaddr_in client, int clen)

  Send an ack datagram to a socket.
- void send_error (int sequence_number, int clisock, sockaddr_in client, int clen)

  Send an error datagram to a socket.
- int send_dgram (int socket, const struct sockaddr_in *cli, int dlen, const mftp_packet data)

  Sends a datagram to a client.
- mftp_packet parse_dgram (unsigned char buffer[])

  Parses incoming datagrams.

4.3.1 Macro Definition Documentation

4.3.1.1 #define ACK 3

4.3.1.2 #define DATA 2

4.3.1.3 #define ERROR 4

4.3.1.4 #define START 1

Flags for custom packet.

4.3.2 Typedef Documentation

4.3.2.1 typedef struct mftp_packet mftp_packet

My custom protocol packet.

4.3.2.2 typedef mftp_packet* mftp_packet_ref

4.3.2.3 typedef struct sockaddr sockaddr

4.3.2.4 typedef struct sockaddr_in sockaddr_in

4.3.3 Function Documentation

4.3.3.1 unsigned char* deserialize_data (unsigned char * *buffer*, char *buf[]*, int *len*)

Deserializes an char array into a unsigned char array.

Parameters

buffer	The array to get the data from.
buf	The buffer to save it.
len	Then length of buf.

Returns

A pointer to the next free space in the buffer.

4.3.3.2 unsigned char* deserialize_int (unsigned char * *buffer*, unsigned int * *val*)

Deserializes an int into a unsigned char.

Parameters

buffer	The array to get the data out of.
val	The value to save the data.

Returns

A pointer to the next free space in the buffer.

4.3.3.3 mftp_packet deserialize_packet (unsigned char *buffer[]*)

Deserialize buffer into mftp_packet.

Parameters

buffer	The buffer to get data from.
len	The length of the buffer.

4.3.3.4 mftp_packet parse_dgram (unsigned char *buffer[]*)

Parses incoming datagrams.

runs the deserializer.

Parameters

buffer	The buffer to parse into a mftp struct

Returns

A mftp_packet filled with data.

4.3.3.5 void send_ack (int *sequence_number,* int *clisock,* sockaddr_in *client,* int *clen*)

Send an ack datagram to a socket.

Parameters

sequence_number	The sequence number of the datagram
clisock	The socket to send the data to.
client	The reciever.
clen	The length of the sockaddr_in struct.

4.3.3.6 int send_dgram (int *socket,* const struct sockaddr_in * *cli,* int *dlen,* const mftp_packet *data*)

Sends a datagram to a client.

Parameters

socket	The socket to send to.
cli	the structure with the ip and port to send to.
dlen	length of the stucture cli.
data	The custom packet with data and flags etc.

Returns

Returns 1 if successful and 0 if it fails. Approriate messages are printed to stderr.

4.3.3.7 void send_error (int *sequence_number,* int *clisock,* sockaddr_in *client,* int *clen*)

Send an error datagram to a socket.

Parameters

sequence_number	The sequence number of the datagram
clisock	The socket to send the data to.
client	The reciever.
clen	The length of the sockaddr_in struct.

4.3.3.8 unsigned char* serialize_data (unsigned char * *buffer,* char *buf[ ],* int *len*)

Serializes an char array into a unsigned char array.

Parameters

buffer	The array to insert the data.
buf	The value to serialize.
len	Then length of buf.

Returns

A pointer to the next free space in the buffer.

4.3.3.9 unsigned char* serialize_int (unsigned char * *buffer*, unsigned int *val*)

Serializes an int into a unsigned char.

Parameters

buffer	The array to insert the data.
val	The value to serialize.

Returns

A pointer to the next free space in the buffer.

4.3.3.10 unsigned char* serialize_packet (mftp_packet *packet*, unsigned char *buffer[]*)

Serialize mftp_packet into a buffer.

Parameters

packet	The packet to be serialized into a buffer.
buffer	The buffer to fill up/
len	The length of the buffer.

4.4 server.c File Reference

```
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include <sys/types.h>
#include <errno.h>
#include <sys/socket.h>
#include <netdb.h>
#include <netinet/in.h>
#include <arpa/inet.h>
#include <unistd.h>
#include <sys/select.h>
#include <time.h>
#include <sys/ioctl.h>
#include <pthread.h>
#include "utils.h"
#include "rudp.h"
```

Data Structures

- struct client_ip_port

Macros

- #define SUCCESS 0
- #define FAILURE 1

Functions

- void * handle_client_request (void *clisock)
- void close_client (int clisock, fd_set *master)
- unsigned char * serialize_datastruct (struct client_ip_port p, unsigned char buffer[])
- struct client_ip_port deserialize_datastruct (unsigned char buffer[])
- int main (int argc, char **argv)

4.4.1 Macro Definition Documentation

4.4.1.1 #define FAILURE 1

4.4.1.2 #define SUCCESS 0

4.4.2 Function Documentation

4.4.2.1 void close_client (int *clisock*, fd_set * *master*)

4.4.2.2 struct client_ip_port deserialize_datastruct (unsigned char *buffer[]*) [read]

4.4.2.3 void * handle_client_request (void * *clisock*)

4.4.2.4 int main (int *argc*, char ** *argv*)

4.4.2.5 unsigned char * serialize_datastruct (struct client_ip_port *p*, unsigned char *buffer[]*)

4.5 utils.c File Reference

```
#include <stdlib.h>
#include <stdio.h>
#include <unistd.h>
#include <errno.h>
#include <string.h>
#include <stdarg.h>
#include <dirent.h>
#include <sys/stat.h>
#include "utils.h"
#include "rudp.h"
```

Macros

- #define SUCCESS 0
- #define FAILURE 1

Functions

- void check_socket (int fd)

  Checks the return value of the socket(3) networking api call for any errors and prints messages and sets the exit status accordingly.
- void check_connection (int x)

  Checks the return value of the connect(3) networking api call for any errors and prints messages and sets the exit status accordingly.
- FILE * retrieve_file (const char *restrict filename, const char *restrict mode)

  Checks the current directory for the file filename.
- int get_file_size (FILE *restrict file)

  Takes a file and gives back the size of the file.
- mftp_packet get_file_chunk (int f_offset, FILE *restrict stream, int seq, int chunksize, int cnum)

  Gets a chunk of a file to a client socket.
- void debugprintf (char *format,...)

4.5.1 Macro Definition Documentation

4.5.1.1 #define FAILURE 1

4.5.1.2 #define SUCCESS 0

4.5.2 Function Documentation

4.5.2.1 void check_connection (int *val*)

Checks the return value of the connect(3) networking api call for any errors and prints messages and sets the exit status accordingly.

Parameters

val	The return value from the connect(3) call.

4.5.2.2 void check_socket (int *fd*)

Checks the return value of the socket(3) networking api call for any errors and prints messages and sets the exit status accordingly.

Parameters

fd	The file descriptor returned by the socket(3) call.

4.5.2.3 void debugprintf (char * *format,* ...)

4.5.2.4 mftp_packet get_file_chunk (int *f_offset,* FILE *restrict *stream,* int *seq,* int *chinksize,* int *cnum*)

Gets a chunk of a file to a client socket.

Parameters

f_offset	The offset to index into the file.
stream	The file to read from to send the chunk.
seq	The sequence number.
chunksize	The chunksize of that the thread is serving.
cnum	The connection number of the n connections (0 - n-1).

4.5.2.5 int get_file_size (FILE *restrict *filename*)

Takes a file and gives back the size of the file.

Parameters

filename	The file in which you want the size of.

Returns

The size of the file filename, or -1 if an error occurs. Errno will be set to the proper error.

4.5.2.6 FILE* retrieve_file (const char *restrict *filename,* const char *restrict *mode*)

Checks the current directory for the file filename.

If file name is found retrieve_file will attepmt to open the file using fopen. If not an error message will be returned. fclose(3) must be called or memory leak will occur.

Parameters

filename	The file to be searched for and opened.
mode	The mode in which the file will be opened.

Returns

The file descriptor for the file if fopen succeeds. Otherwise NULL is returned if filename is not found, or if fopen fails.

4.6 utils.h File Reference

```
#include "rudp.h"
```

Macros

- #define DEBUGF(...) debugprintf (__VA_ARGS__)

  Allows for debugging print statements to be made and easily turned off for release build.

Enumerations

- enum bool { FALSE = 0, TRUE = 1 }

  A boolean data type created by an enum.

Functions

- void check_socket (int fd)

  Checks the return value of the socket(3) networking api call for any errors and prints messages and sets the exit status accordingly.
- void check_connection (int val)

  Checks the return value of the connect(3) networking api call for any errors and prints messages and sets the exit status accordingly.

- FILE * retrieve_file (const char *restrict filename, const char *restrict mode)

  Checks the current directory for the file filename.
- int get_file_size (FILE *restrict filename)

  Takes a file and gives back the size of the file.
- mftp_packet get_file_chunk (int f_offset, FILE *restrict stream, int seq, int chinksize, int cnum)

  Gets a chunk of a file to a client socket.
- void debugprintf (char *format,...)

4.6.1 Macro Definition Documentation

4.6.1.1 #define DEBUGF(...) debugprintf (__VA_ARGS__)

Allows for debugging print statements to be made and easily turned off for release build.

Parameters

format	The format string to format the print statement.

4.6.2 Enumeration Type Documentation

4.6.2.1 enum bool

A boolean data type created by an enum.

Enumerator:

FALSE

TRUE

4.6.3 Function Documentation

4.6.3.1 void check_connection (int *val*)

Checks the return value of the connect(3) networking api call for any errors and prints messages and sets the exit status accordingly.

Parameters

val	The return value from the connect(3) call.

4.6.3.2 void check_socket (int *fd*)

Checks the return value of the socket(3) networking api call for any errors and prints messages and sets the exit status accordingly.

Parameters

fd	The file descriptor returned by the socket(3) call.

4.6.3.3 void debugprintf (char * *format,* ...)

4.6.3.4 mftp_packet get_file_chunk (int *f_offset,* FILE *restrict *stream,* int *seq,* int *chinksize,* int *cnum*)

Gets a chunk of a file to a client socket.

Parameters

f_offset	The offset to index into the file.
stream	The file to read from to send the chunk.
seq	The sequence number.
chunksize	The chunksize of that the thread is serving.
cnum	The connection number of the n connections (0 - n-1).

4.6.3.5 int get_file_size (FILE *restrict *filename*)

Takes a file and gives back the size of the file.

Parameters

filename	The file in which you want the size of.

Returns

The size of the file filename, or -1 if an error occurs. Errno will be set to the proper error.

4.6.3.6 FILE* retrieve_file (const char *restrict *filename,* const char *restrict *mode*)

Checks the current directory for the file filename.

If file name is found retrieve_file will attepmt to open the file using fopen. If not an error message will be returned. fclose(3) must be called or memory leak will occur.

Parameters

filename	The file to be searched for and opened.
mode	The mode in which the file will be opened.

Returns

The file descriptor for the file if fopen succeeds. Otherwise NULL is returned if filename is not found, or if fopen fails.