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ОТЧЕТ О ЛАБОРАТОРНОЙ РАБОТЕ

Лабораторная работа No 5. Взаимодействие процессов в ОС GNU/Linux

тема

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1 Цель работы с постановкой задачи

1.1 Цель работы

Изучение особенностей межпроцессного взаимодействия в ОС GNU/Linux.

1.2 Задача работы

Требуется: разработать две программы: первая реализует серверную часть, вторая — клиентскую часть. Обмен данными между ними организуется посредством механизма Internet-сокетов и протокола TCP либо UDP. Результат выполнения выводится на терминал/консоль. Должен использоваться интерфейс командной строки (CLI). При реализации обязательно использование изученных в лекционном курсе системных вызовов (ОС Linux), предназначенных для работы с сокетами. Программный код, относящийся к пользовательскому интерфейсу, должен быть физически отделен от кода, реализующего межпроцессное взаимодействие, и оба они, в свою очередь, отделены от кода реализации основной логики, например, вычислений. Допускается реализация одной программы в форме Windows-приложения, авторой — в форме Linux-приложения. Далее оговаривается функционал клиентской и серверной частей. Обе части должны быть устойчивы к некорректному пользовательскому вводу. В нечетных вариантах заданий используются потоковые сокеты, в четных — дейтаграммные сокеты.

Вариант 16. Клиент отправляет серверу элементы двух квадратных матриц одинакового размера. Его, а также сами элементы матриц должен вводить пользователь. Сервер принимает две квадратные матрицы, а затем выводит на экран сумму матриц, а также определитель суммарной матрицы.

Используются дейтаграммные сокеты по протоколу UDP.

1.3 Описание и пояснение к работе

Используется система сборки Autotools на Linux и CMake на Windows и Linux. Используется интерфейс командной строки. Для сборки, вывода справки клиента и сервера требуется:

```
# linux, autotools, make, gcc
./configure
make
./build/Lab_05_Client -h
./build/Lab_05_Server -h

# linux, autotools, make, clang
./configure CC=clang
make
./build/Lab_05_Client -h
./build/Lab_05_Server -h

# linux, cmake, make, gcc
mkdir buildcmake
cd buildcmake
cmake ..
make
./Lab_05_Client/Lab_05_Client -h
./Lab_05_Server/Lab_05_Server -h

# linux, cmake, make, clang
mkdir buildcmake
cd buildcmake
cmake -DCMAKE_C_COMPILER=clang ..
make
./Lab_05_Client/Lab_05_Client -h
./Lab_05_Server/Lab_05_Server -h

# linux, cmake, ninja, clang
mkdir buildcmake
cd buildcmake
cmake -G "Ninja" -DCMAKE_C_COMPILER=clang ..
ninja
./Lab_05_Client/Lab_05_Client -h
./Lab_05_Server/Lab_05_Server -h

# windows, cmake, msbuild, msvc
mkdir buildcmake
cd buildcmake
cmake -G "Visual Studio 16 2019" ..
msbuild .\ALL_BUILD.vcxproj
.\Lab_05_Client\Debug\Lab_05_Client.exe -h
.\Lab_05_Server\Debug\Lab_05_Server.exe -h

# windows, cmake, mingw32-make, mingw
mkdir buildcmake
cd buildcmake
```

```

cmake -G "MinGW Makefiles" ..
mingw32-make
.\Lab_05_Client\Lab_05_Client.exe -h
.\Lab_05_Server\Lab_05_Server.exe -h

# windows, cmake, mingw32-make, clang
mkdir buildcmake
cd buildcmake
cmake -G "MinGW Makefiles" -DCMAKE_C_COMPILER=clang -DCMAKE_CXX_COMPILER=clang++ ..
mingw32-make
.\Lab_05_Client\Lab_05_Client.exe -h
.\Lab_05_Server\Lab_05_Server.exe -h

# windows, cmake, ninja, clang
mkdir buildcmake
cd buildcmake
cmake -G "Ninja" -DCMAKE_C_COMPILER=clang -DCMAKE_CXX_COMPILER=clang++ -
DCMAKE_RC_COMPILER=llvm-rc ..
ninja
.\Lab_05_Client\Lab_05_Client.exe -h
.\Lab_05_Server\Lab_05_Server.exe -h

```

2 Исходные тексты программ (с комментариями в стиле системы doxygen)

Исходные тексты программ предоставлены в архиве.

3 Содержимое скрипта configure

3.1 configure

Предоставлен в архиве.

3.2 configure.ac

```

#                                     -*- Autoconf -*-
# Process this file with autoconf to produce a configure script.

AC_PREREQ([2.69])
AC_INIT([Lab_05], [3.0], [misterptits@yandex.ru])
AC_CONFIG_SRCDIR([Lab_05_Client/main.c])

# Checks for programs.
AC_PROG_CC

```

```

# Checks for libraries.

# Checks for header files.
AC_CHECK_HEADERS([arpa/inet.h fcntl.h limits.h malloc.h netinet/in.h stddef.h stdint.h
stdlib.h string.h sys/socket.h unistd.h])

# Checks for typedefs, structures, and compiler characteristics.
AC_CHECK_HEADER_STDBOOL
AC_TYPE_SIZE_T
AC_TYPE_UINT16_T
AC_TYPE_UINT32_T

# Checks for library functions.
AC_FUNC_MALLOC
AC_FUNC_REALLOC
AC_FUNC_STRERROR_R
AC_CHECK_FUNCS([socket strchr])

AM_INIT_AUTOMAKE
AC_PROG_RANLIB

AC_CONFIG_FILES([build/Makefile
    Makefile])
AC_OUTPUT

```

3.3 Makefile.am

```
SUBDIRS = build
```

3.4 build/Makefile.am

```

AUTOMAKE_OPTIONS = subdir-objects

noinst_LIBRARIES = libLab_05_Lib.a libLab_05_MatrixLib.a
bin_PROGRAMS = Lab_05_Client Lab_05_Server

libLab_05_MatrixLib_a_SOURCES = \
    ../Lab_05_MatrixLib/Matrix.c
libLab_05_MatrixLib_a_CFLAGS = -std=gnu99

libLab_05_Lib_a_SOURCES = \
    ../Lab_05_Lib/Uutils.c \
    ../Lab_05_Lib/Args.c \
    ../Lab_05_Lib/ArgsPrivate.c \
    ../Lab_05_Lib/ReturnCodes.c \
    ../Lab_05_Lib/LastErrorMessage.c \
    ../Lab_05_Lib/Request.c \
    ../Lab_05_Lib/Socket.c
libLab_05_Lib_a_CFLAGS = -I../Lab_05_MatrixLib -std=gnu99
libLab_05_Lib_a_LIBADD = libLab_05_MatrixLib.a

Lab_05_Client_SOURCES = \
    ../Lab_05_Client/ClientArgs.c \

```

```

    ../Lab_05_Client/Client.c \
    ../Lab_05_Client/main.c
Lab_05_Client_CFLAGS = -I../Lab_05_MatrixLib -I../Lab_05_Lib -std=gnu99
Lab_05_Client_LDADD = libLab_05_MatrixLib.a libLab_05_Lib.a

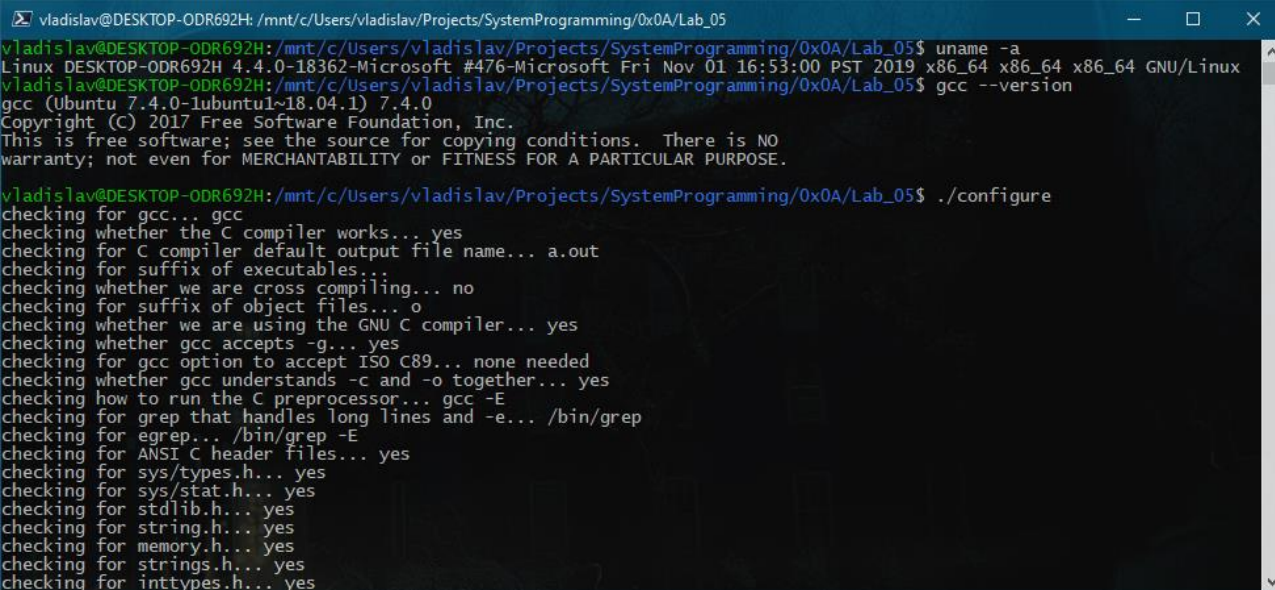
Lab_05_Server_SOURCES = \
    ../Lab_05_Server/ServerArgs.c \
    ../Lab_05_Server/Server.c \
    ../Lab_05_Server/main.c
Lab_05_Server_CFLAGS = -I../Lab_05_MatrixLib -I../Lab_05_Lib -std=gnu99
Lab_05_Server_LDADD = libLab_05_MatrixLib.a libLab_05_Lib.a

```

4 Тестовые примеры работы программ

4.1 Запуск №1 (с помощью loopback; сервер – WSL Ubuntu 18.04, GCC; клиент – Windows 10, MSVC)

4.1.1. Сборка с помощью autotools на сервере



```

vladislav@DESKTOP-ODR692H: /mnt/c/Users/vladislav/Projects/SystemProgramming/0x0A/Lab_05
vladislav@DESKTOP-ODR692H: /mnt/c/Users/vladislav/Projects/SystemProgramming/0x0A/Lab_05$ uname -a
Linux DESKTOP-ODR692H 4.4.0-18362-Microsoft #476-Microsoft Fri Nov 01 16:53:00 PST 2019 x86_64 x86_64 GNU/Linux
vladislav@DESKTOP-ODR692H: /mnt/c/Users/vladislav/Projects/SystemProgramming/0x0A/Lab_05$ gcc --version
gcc (Ubuntu 7.4.0-1ubuntu1~18.04.1) 7.4.0
Copyright (C) 2017 Free Software Foundation, Inc.
This is free software; see the source for copying conditions. There is NO
warranty; not even for MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.

vladislav@DESKTOP-ODR692H: /mnt/c/Users/vladislav/Projects/SystemProgramming/0x0A/Lab_05$ ./configure
checking for gcc... gcc
checking whether the C compiler works... yes
checking for C compiler default output file name... a.out
checking for suffix of executables...
checking whether we are cross compiling... no
checking for suffix of object files... o
checking whether we are using the GNU C compiler... yes
checking whether gcc accepts -g... yes
checking for gcc option to accept ISO C89... none needed
checking whether gcc understands -c and -o together... yes
checking how to run the C preprocessor... gcc -E
checking for grep that handles long lines and -e... /bin/grep
checking for egrep... /bin/grep -E
checking for ANSI C header files... yes
checking for sys/types.h... yes
checking for sys/stat.h... yes
checking for stdlib.h... yes
checking for string.h... yes
checking for memory.h... yes
checking for strings.h... yes
checking for inttypes.h... yes

```

Рисунок 1 – Запуск ./configure


```
vladislav@DESKTOP-ODR692H: /mnt/c/Users/vladislav/Projects/SystemProgramming/0x0A/Lab_05
checking for a BSD-compatible install... /usr/bin/install -c
checking whether build environment is sane... yes
checking for a thread-safe mkdir -p... /bin/mkdir -p
checking for gawk... gawk
checking whether make sets $(MAKE)... yes
checking for style of include used by make... GNU
checking whether make supports nested variables... yes
checking dependency style of gcc... gcc3
checking for ranlib... ranlib
checking that generated files are newer than configure... done
configure: creating ./config.status
config.status: creating build/Makefile
config.status: creating Makefile
config.status: executing depfiles commands
vladislav@DESKTOP-ODR692H: /mnt/c/Users/vladislav/Projects/SystemProgramming/0x0A/Lab_05$ make
Making all in build
make[1]: Entering directory '/mnt/c/Users/vladislav/Projects/SystemProgramming/0x0A/Lab_05/build'
gcc -DPACKAGE_NAME=\"Lab_05\" -DPACKAGE_TARNAME=\"lab_05\" -DPACKAGE_VERSION=\"3.0\" -DPACKAGE_STRING=\"Lab_05\\ 3.0\" -D
PACKAGE_BUGREPORT=\"misterptits@yandex.ru\" -DPACKAGE_URL=\"\" -DSTDC_HEADERS=1 -DHAVE_SYS_TYPES_H=1 -DHAVE_SYS_STAT_H=1
-DHAVE_STDLIB_H=1 -DHAVE_STRING_H=1 -DHAVE_MEMORY_H=1 -DHAVE_STRINGS_H=1 -DHAVE_INTTYPES_H=1 -DHAVE_STDINT_H=1 -DHAVE_U
NISTD_H=1 -DHAVE_ARPA_INET_H=1 -DHAVE_FCNTL_H=1 -DHAVE_LIMITS_H=1 -DHAVE_MALLOC_H=1 -DHAVE_NETINET_IN_H=1 -DHAVE_STDDEF_
H=1 -DHAVE_STDINT_H=1 -DHAVE_STDLIB_H=1 -DHAVE_STRING_H=1 -DHAVE_SYS_SOCKET_H=1 -DHAVE_UNISTD_H=1 -DHAVE__BOOL=1 -DHAVE_
STDLIB_H=1 -DHAVE_MALLOC=1 -DHAVE_STDLIB_H=1 -DHAVE_REALLOC=1 -DHAVE_DECL_STRERROR_R=1 -DHAVE_STRERROR_R=1 -DHAVE_SOCKET
=1 -DHAVE_STRCHR=1 -DPACKAGE=\"lab_05\" -DVERSION=\"3.0\" -I. -I../Lab_05_MatrixLib -std=gnu99 -g -O2 -MT ../Lab_05_L
ib/libLab_05_Lib_a-Utils.o -MD -MP -MF ../Lab_05_Lib/.deps/libLab_05_Lib_a-Utils.Tpo -c -o ../Lab_05_Lib/libLab_05_Lib_a
-Utils.o `test -f ../Lab_05_Lib/Utils.c` || echo `./../Lab_05_Lib/Utils.c
mv -f ../Lab_05_Lib/.deps/libLab_05_Lib_a-Utils.Tpo ../Lab_05_Lib/.deps/libLab_05_Lib_a-Utils.Po
gcc -DPACKAGE_NAME=\"Lab_05\" -DPACKAGE_TARNAME=\"lab_05\" -DPACKAGE_VERSION=\"3.0\" -DPACKAGE_STRING=\"Lab_05\\ 3.0\" -D
PACKAGE_BUGREPORT=\"misterptits@yandex.ru\" -DPACKAGE_URL=\"\" -DSTDC_HEADERS=1 -DHAVE_SYS_TYPES_H=1 -DHAVE_SYS_STAT_H=1
-DHAVE_STDLIB_H=1 -DHAVE_STRING_H=1 -DHAVE_MEMORY_H=1 -DHAVE_STRINGS_H=1 -DHAVE_INTTYPES_H=1 -DHAVE_STDINT_H=1 -DHAVE_U
```

Рисунок 2 – Конец работы ./configure, запуск make

```
vladislav@DESKTOP-ODR692H: /mnt/c/Users/vladislav/Projects/SystemProgramming/0x0A/Lab_05
../Lab_05_Server/Lab_05_Server-ServerArgs.o `test -f ../Lab_05_Server/ServerArgs.c` || echo `./../Lab_05_Server/Server
Args.c
mv -f ../Lab_05_Server/.deps/Lab_05_Server-ServerArgs.Tpo ../Lab_05_Server/.deps/Lab_05_Server-ServerArgs.Po
gcc -DPACKAGE_NAME=\"Lab_05\" -DPACKAGE_TARNAME=\"lab_05\" -DPACKAGE_VERSION=\"3.0\" -DPACKAGE_STRING=\"Lab_05\\ 3.0\" -D
PACKAGE_BUGREPORT=\"misterptits@yandex.ru\" -DPACKAGE_URL=\"\" -DSTDC_HEADERS=1 -DHAVE_SYS_TYPES_H=1 -DHAVE_SYS_STAT_H=1
-DHAVE_STDLIB_H=1 -DHAVE_STRING_H=1 -DHAVE_MEMORY_H=1 -DHAVE_STRINGS_H=1 -DHAVE_INTTYPES_H=1 -DHAVE_STDINT_H=1 -DHAVE_U
NISTD_H=1 -DHAVE_ARPA_INET_H=1 -DHAVE_FCNTL_H=1 -DHAVE_LIMITS_H=1 -DHAVE_MALLOC_H=1 -DHAVE_NETINET_IN_H=1 -DHAVE_STDDEF_
H=1 -DHAVE_STDINT_H=1 -DHAVE_STDLIB_H=1 -DHAVE_STRING_H=1 -DHAVE_SYS_SOCKET_H=1 -DHAVE_UNISTD_H=1 -DHAVE__BOOL=1 -DHAVE_
STDLIB_H=1 -DHAVE_MALLOC=1 -DHAVE_STDLIB_H=1 -DHAVE_REALLOC=1 -DHAVE_DECL_STRERROR_R=1 -DHAVE_STRERROR_R=1 -DHAVE_SOCKET
=1 -DHAVE_STRCHR=1 -DPACKAGE=\"lab_05\" -DVERSION=\"3.0\" -I. -I../Lab_05_MatrixLib -I../Lab_05_Lib -std=gnu99 -g -O2
-MT ../Lab_05_Server/Lab_05_Server-Server.o -MD -MP -MF ../Lab_05_Server/.deps/Lab_05_Server-Server.Tpo -c -o ../Lab_05
_Server/Lab_05_Server-Server.o `test -f ../Lab_05_Server/Server.c` || echo `./../Lab_05_Server/Server.c
mv -f ../Lab_05_Server/.deps/Lab_05_Server-Server.Tpo ../Lab_05_Server/.deps/Lab_05_Server-Server.Po
gcc -DPACKAGE_NAME=\"Lab_05\" -DPACKAGE_TARNAME=\"lab_05\" -DPACKAGE_VERSION=\"3.0\" -DPACKAGE_STRING=\"Lab_05\\ 3.0\" -D
PACKAGE_BUGREPORT=\"misterptits@yandex.ru\" -DPACKAGE_URL=\"\" -DSTDC_HEADERS=1 -DHAVE_SYS_TYPES_H=1 -DHAVE_SYS_STAT_H=1
-DHAVE_STDLIB_H=1 -DHAVE_STRING_H=1 -DHAVE_MEMORY_H=1 -DHAVE_STRINGS_H=1 -DHAVE_INTTYPES_H=1 -DHAVE_STDINT_H=1 -DHAVE_U
NISTD_H=1 -DHAVE_ARPA_INET_H=1 -DHAVE_FCNTL_H=1 -DHAVE_LIMITS_H=1 -DHAVE_MALLOC_H=1 -DHAVE_NETINET_IN_H=1 -DHAVE_STDDEF_
H=1 -DHAVE_STDINT_H=1 -DHAVE_STDLIB_H=1 -DHAVE_STRING_H=1 -DHAVE_SYS_SOCKET_H=1 -DHAVE_UNISTD_H=1 -DHAVE__BOOL=1 -DHAVE_
STDLIB_H=1 -DHAVE_MALLOC=1 -DHAVE_STDLIB_H=1 -DHAVE_REALLOC=1 -DHAVE_DECL_STRERROR_R=1 -DHAVE_STRERROR_R=1 -DHAVE_SOCKET
=1 -DHAVE_STRCHR=1 -DPACKAGE=\"lab_05\" -DVERSION=\"3.0\" -I. -I../Lab_05_MatrixLib -I../Lab_05_Lib -std=gnu99 -g -O2
-MT ../Lab_05_Server/Lab_05_Server-main.o -MD -MP -MF ../Lab_05_Server/.deps/Lab_05_Server-main.Tpo -c -o ../Lab_05_Ser
ver/Lab_05_Server-main.o `test -f ../Lab_05_Server/main.c` || echo `./../Lab_05_Server/main.c
mv -f ../Lab_05_Server/.deps/Lab_05_Server-main.Tpo ../Lab_05_Server/.deps/Lab_05_Server-main.Po
gcc -I../Lab_05_MatrixLib -I../Lab_05_Lib -std=gnu99 -g -O2 -o Lab_05_Server ../Lab_05_Server/Lab_05_Server-ServerArgs
.o ../Lab_05_Server/Lab_05_Server-Server.o ../Lab_05_Server/Lab_05_Server-main.o libLab_05_MatrixLib.a libLab_05_Lib.a
make[1]: Leaving directory '/mnt/c/Users/vladislav/Projects/SystemProgramming/0x0A/Lab_05/build'
make[1]: Nothing to be done for 'all-am'.
make[1]: Leaving directory '/mnt/c/Users/vladislav/Projects/SystemProgramming/0x0A/Lab_05'
vladislav@DESKTOP-ODR692H: /mnt/c/Users/vladislav/Projects/SystemProgramming/0x0A/Lab_05$
```

Рисунок 3 – Результат работы make

4.1.2. Сборка с помощью CMake и MSBuild на клиенте


```
PowerShell 6 (x64)
PS C:\Users\vladislav\Projects\SystemProgramming\0x0A\Lab_05> mkdir buildcmake

Directory: C:\Users\vladislav\Projects\SystemProgramming\0x0A\Lab_05

Mode                LastWriteTime         Length Name
----                -
d-----          24.11.2019    23:40             buildcmake

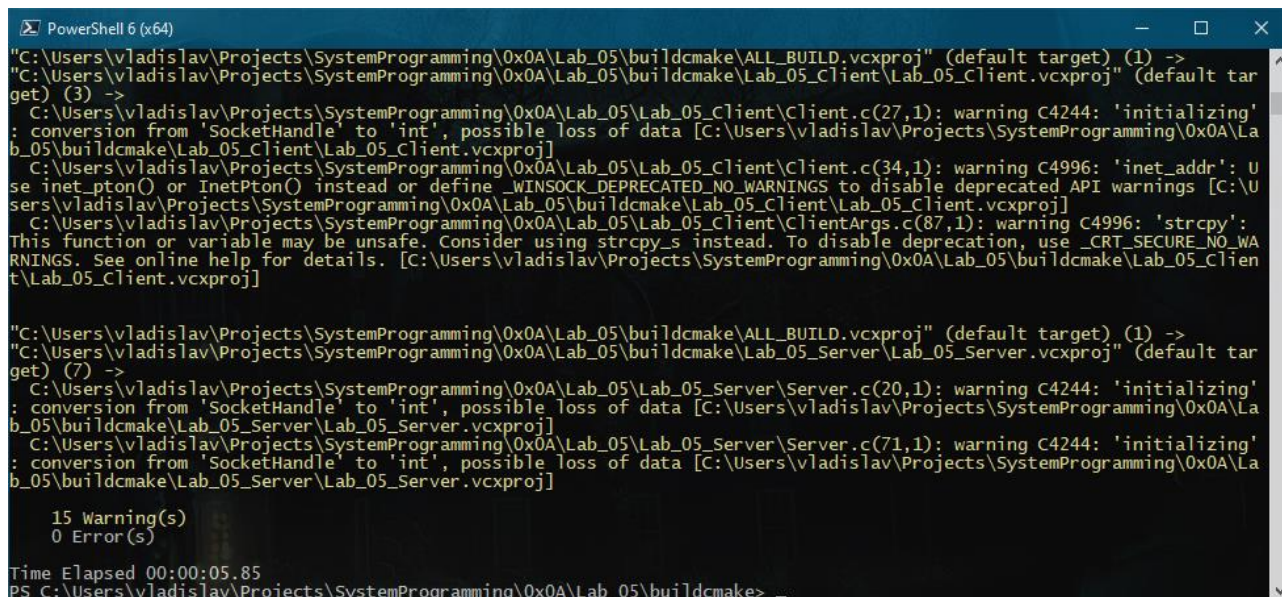
PS C:\Users\vladislav\Projects\SystemProgramming\0x0A\Lab_05> cd buildcmake
PS C:\Users\vladislav\Projects\SystemProgramming\0x0A\Lab_05\buildcmake> cmake -G "Visual Studio 16 2019" ..
-- Selecting Windows SDK version 10.0.18362.0 to target Windows 10.0.18363.
-- The C compiler identification is MSVC 19.24.28207.0
-- The CXX compiler identification is MSVC 19.24.28207.0
-- Check for working C compiler: C:/Program Files (x86)/Microsoft Visual Studio/2019/Preview/VC/Tools/MSVC/14.24.28207/b
in/Hostx64/x64/cl.exe
-- Check for working C compiler: C:/Program Files (x86)/Microsoft Visual Studio/2019/Preview/VC/Tools/MSVC/14.24.28207/b
in/Hostx64/x64/cl.exe -- works
-- Detecting C compiler ABI info
-- Detecting C compiler ABI info - done
-- Detecting C compile features
-- Detecting C compile features - done
-- Check for working CXX compiler: C:/Program Files (x86)/Microsoft Visual Studio/2019/Preview/VC/Tools/MSVC/14.24.28207
/bin/Hostx64/x64/cl.exe
-- Check for working CXX compiler: C:/Program Files (x86)/Microsoft Visual Studio/2019/Preview/VC/Tools/MSVC/14.24.28207
/bin/Hostx64/x64/cl.exe -- works
-- Detecting CXX compiler ABI info
-- Detecting CXX compiler ABI info - done
-- Detecting CXX compile features
-- Detecting CXX compile features - done
```

Рисунок 4 – Запуск cmake

```
PowerShell 6 (x64)
-- Detecting CXX compile features - done
-- Configuring done
-- Generating done
-- Build files have been written to: C:/Users/vladislav/Projects/SystemProgramming/0x0A/Lab_05/buildcmake
PS C:\Users\vladislav\Projects\SystemProgramming\0x0A\Lab_05\buildcmake> msbuild .\ALL_BUILD.vcxproj
Microsoft (R) Build Engine version 16.4.0-preview-19502-03+3af680463 for .NET Framework
Copyright (C) Microsoft Corporation. All rights reserved.

Build started 24.11.2019 23:41:38.
Project "C:\Users\vladislav\Projects\SystemProgramming\0x0A\Lab_05\buildcmake\ALL_BUILD.vcxproj" on node 1 (default tar
gets).
Project "C:\Users\vladislav\Projects\SystemProgramming\0x0A\Lab_05\buildcmake\ALL_BUILD.vcxproj" (1) is building "C:\Us
ers\vladislav\Projects\SystemProgramming\0x0A\Lab_05\buildcmake\ZERO_CHECK.vcxproj" (2) on node 1 (default targets).
PrepareForBuild:
  Creating directory "x64\Debug\ZERO_CHECK\".
  Creating directory "x64\Debug\ZERO_CHECK\ZERO_CHECK.tlog\".
InitializeBuildStatus:
  Creating "x64\Debug\ZERO_CHECK\ZERO_CHECK.tlog\unsuccessfulbuild" because "AlwaysCreate" was specified.
CustomBuild:
  Checking Build System
FinalizeBuildStatus:
  Deleting file "x64\Debug\ZERO_CHECK\ZERO_CHECK.tlog\unsuccessfulbuild".
  Touching "x64\Debug\ZERO_CHECK\ZERO_CHECK.tlog\ZERO_CHECK.lastbuildstate".
Done Building Project "C:\Users\vladislav\Projects\SystemProgramming\0x0A\Lab_05\buildcmake\ZERO_CHECK.vcxproj" (defaul
t targets).
Project "C:\Users\vladislav\Projects\SystemProgramming\0x0A\Lab_05\buildcmake\ALL_BUILD.vcxproj" (1) is building "C:\Us
ers\vladislav\Projects\SystemProgramming\0x0A\Lab_05\buildcmake\Lab_05_Client\Lab_05_Client.vcxproj" (3) on node 1 (def
ault targets).
Project "C:\Users\vladislav\Projects\SystemProgramming\0x0A\Lab_05\buildcmake\Lab_05_Client\Lab_05_Client.vcxproj" (3)
```

Рисунок 5 – Запуск msbuild



```
PowerShell 6 (x64)
"C:\Users\vladislav\Projects\SystemProgramming\0x0A\Lab_05\buildcmake\ALL_BUILD.vcxproj" (default target) (1) ->
"C:\Users\vladislav\Projects\SystemProgramming\0x0A\Lab_05\buildcmake\Lab_05_Client\Lab_05_Client.vcxproj" (default target) (3) ->
  C:\Users\vladislav\Projects\SystemProgramming\0x0A\Lab_05\Lab_05_Client\Client.c(27,1): warning C4244: 'initializing': conversion from 'SocketHandle' to 'int', possible loss of data [C:\Users\vladislav\Projects\SystemProgramming\0x0A\Lab_05\buildcmake\Lab_05_Client\Lab_05_Client.vcxproj]
  C:\Users\vladislav\Projects\SystemProgramming\0x0A\Lab_05\Lab_05_Client\Client.c(34,1): warning C4996: 'inet_addr': Use inet_pton() or InetPton() instead or define _WINSOCK_DEPRECATED_NO_WARNINGS to disable deprecated API warnings [C:\Users\vladislav\Projects\SystemProgramming\0x0A\Lab_05\buildcmake\Lab_05_Client\Lab_05_Client.vcxproj]
  C:\Users\vladislav\Projects\SystemProgramming\0x0A\Lab_05\Lab_05_Client\ClientArgs.c(87,1): warning C4996: 'strcpy': This function or variable may be unsafe. Consider using strcpy_s instead. To disable deprecation, use _CRT_SECURE_NO_WARNINGS. See online help for details. [C:\Users\vladislav\Projects\SystemProgramming\0x0A\Lab_05\buildcmake\Lab_05_Client\Lab_05_Client.vcxproj]

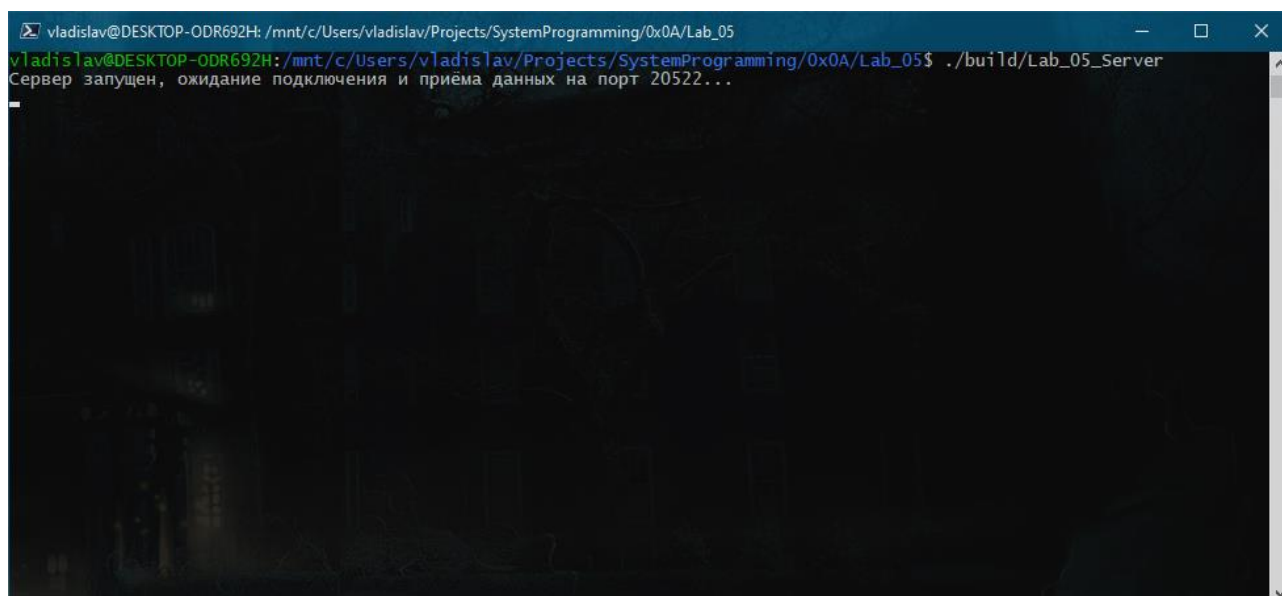
"C:\Users\vladislav\Projects\SystemProgramming\0x0A\Lab_05\buildcmake\ALL_BUILD.vcxproj" (default target) (1) ->
"C:\Users\vladislav\Projects\SystemProgramming\0x0A\Lab_05\buildcmake\Lab_05_Server\Lab_05_Server.vcxproj" (default target) (7) ->
  C:\Users\vladislav\Projects\SystemProgramming\0x0A\Lab_05\Lab_05_Server\Server.c(20,1): warning C4244: 'initializing': conversion from 'SocketHandle' to 'int', possible loss of data [C:\Users\vladislav\Projects\SystemProgramming\0x0A\Lab_05\buildcmake\Lab_05_Server\Lab_05_Server.vcxproj]
  C:\Users\vladislav\Projects\SystemProgramming\0x0A\Lab_05\Lab_05_Server\Server.c(71,1): warning C4244: 'initializing': conversion from 'SocketHandle' to 'int', possible loss of data [C:\Users\vladislav\Projects\SystemProgramming\0x0A\Lab_05\buildcmake\Lab_05_Server\Lab_05_Server.vcxproj]

    15 Warning(s)
    0 Error(s)

Time Elapsed 00:00:05.85
PS C:\Users\vladislav\Projects\SystemProgramming\0x0A\Lab_05\buildcmake>
```

Рисунок 6 – Конец работы msbuild

4.1.3. Запуск сервера



```
vladislav@DESKTOP-ODR692H: /mnt/c/Users/vladislav/Projects/SystemProgramming/0x0A/Lab_05$ ./build/Lab_05_Server
Сервер запущен, ожидание подключения и приема данных на порт 20522...
```

Рисунок 7 – Сервер ожидает подключения от клиента

4.1.4. Запуск клиента


```
PowerShell 6 (x64)
PS C:\Users\vladislav\Projects\SystemProgramming\0x0A\Lab_05\buildcmake> .\Lab_05_Client\Debug\Lab_05_Client.exe
Степень матрицы натуральное число.
Введите степень матриц: 3
Элементы матриц - целые числа
Введите элемент матрицы A[0][0]: 1
Введите элемент матрицы A[0][1]: 2
Введите элемент матрицы A[0][2]: 3
Введите элемент матрицы A[1][0]: 4
Введите элемент матрицы A[1][1]: 5
Введите элемент матрицы A[1][2]: 6
Введите элемент матрицы A[2][0]: 7
Введите элемент матрицы A[2][1]: 8
Введите элемент матрицы A[2][2]: 9
Введите элемент матрицы B[0][0]: 123
Введите элемент матрицы B[0][1]: -234
Введите элемент матрицы B[0][2]: 32
Введите элемент матрицы B[1][0]: gdfg
Введите элемент матрицы B[1][1]: 345g
Введите элемент матрицы B[1][2]: 3
Введите элемент матрицы B[2][0]: 4
Введите элемент матрицы B[2][1]: 5
Введите элемент матрицы B[2][2]: 6
Введите элемент матрицы B[2][3]: 7
Введите элемент матрицы B[2][4]: 8
Введённые матрицы:
Матрица A:
1 2 3
4 5 6
7 8 9
Матрица B:
123 -234 32
3 4 5
6 7 8
Передача на 127.0.0.1:20522...
Успешно передано.
PS C:\Users\vladislav\Projects\SystemProgramming\0x0A\Lab_05\buildcmake>
```

Рисунок 8 – Клиент считал данные, передал и успешно завершился

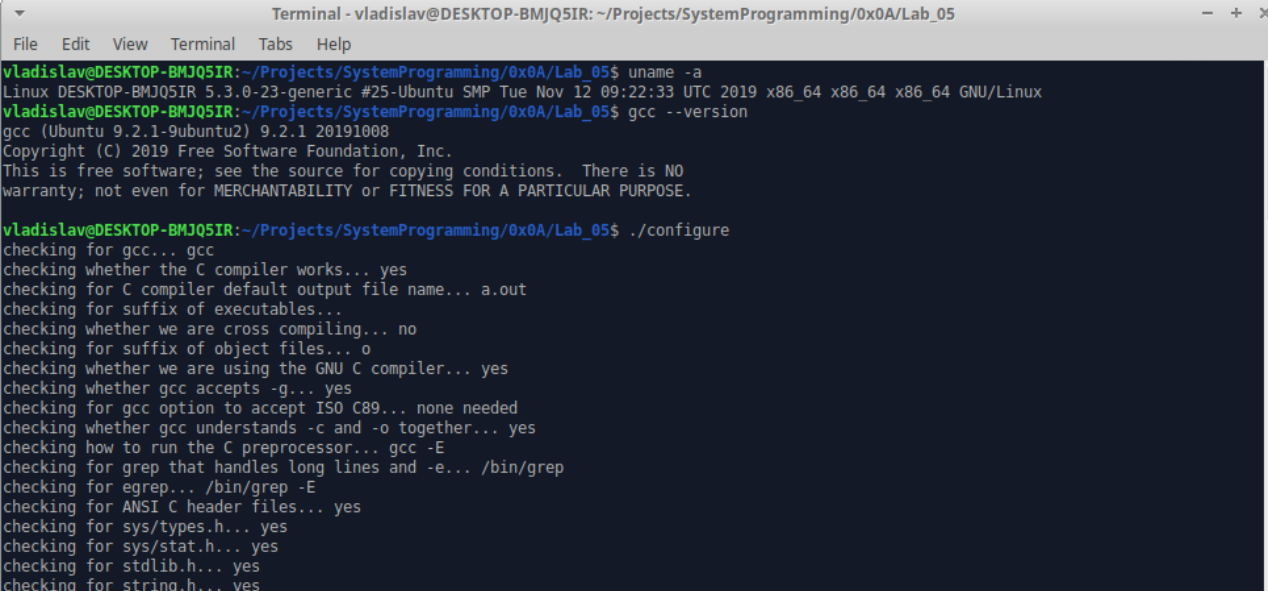
4.1.5. Результат работы сервера

```
vladislav@DESKTOP-ODR692H: /mnt/c/Users/vladislav/Projects/SystemProgramming/0x0A/Lab_05$ ./build/Lab_05_Server
Сервер запущен, ожидание подключения и приёма данных на порт 20522...
Принятые матрицы от клиента 127.0.0.1:
Матрица A:
1 2 3
4 5 6
7 8 9
Матрица B:
123 -234 32
3 4 5
6 7 8
Матрица A+B:
124 -232 35
7 9 11
13 15 17
Определитель: -7476
vladislav@DESKTOP-ODR692H: /mnt/c/Users/vladislav/Projects/SystemProgramming/0x0A/Lab_05$
```

Рисунок 9 – Сервер принял, вычислил, вывел результат и успешно завершился

4.2 Запуск №2 (по локальной сети; сервер – Ubuntu 19.10, GCC; клиент – Windows 10, Clang)

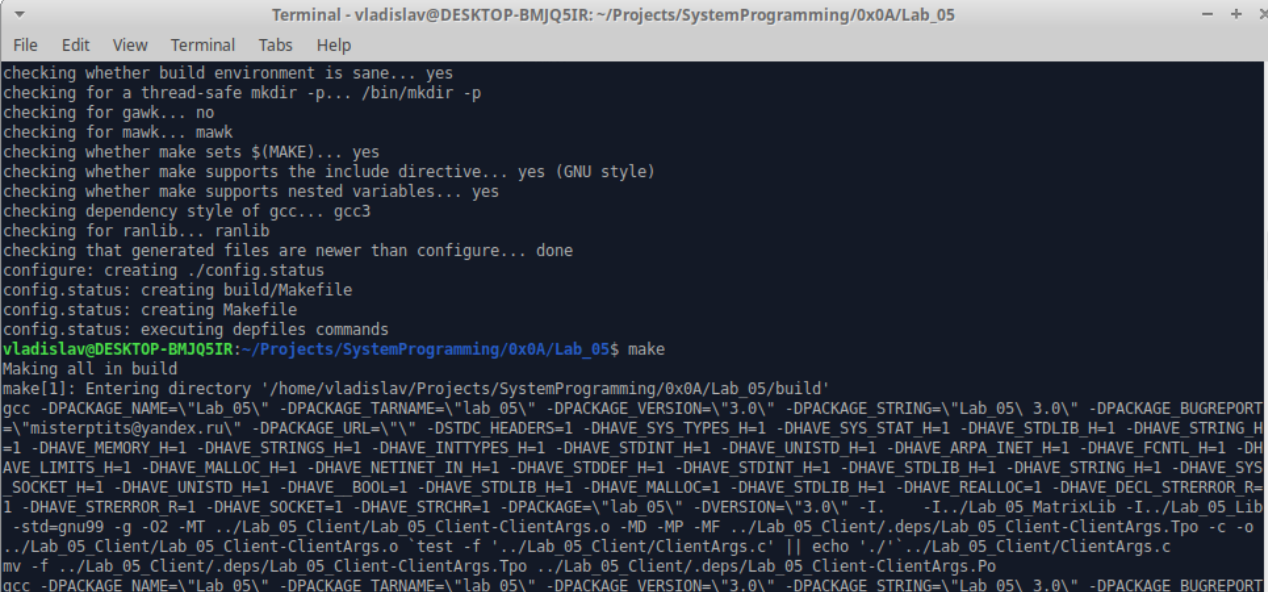
4.2.1. Сборка на сервере с помощью autotools



```
Terminal - vladislav@DESKTOP-BMJQ5IR: ~/Projects/SystemProgramming/0x0A/Lab_05
File Edit View Terminal Tabs Help
vladislav@DESKTOP-BMJQ5IR:~/Projects/SystemProgramming/0x0A/Lab_05$ uname -a
Linux DESKTOP-BMJQ5IR 5.3.0-23-generic #25-Ubuntu SMP Tue Nov 12 09:22:33 UTC 2019 x86_64 x86_64 x86_64 GNU/Linux
vladislav@DESKTOP-BMJQ5IR:~/Projects/SystemProgramming/0x0A/Lab_05$ gcc --version
gcc (Ubuntu 9.2.1-9ubuntu2) 9.2.1 20191008
Copyright (C) 2019 Free Software Foundation, Inc.
This is free software; see the source for copying conditions. There is NO
warranty; not even for MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.

vladislav@DESKTOP-BMJQ5IR:~/Projects/SystemProgramming/0x0A/Lab_05$ ./configure
checking for gcc... gcc
checking whether the C compiler works... yes
checking for C compiler default output file name... a.out
checking for suffix of executables...
checking whether we are cross compiling... no
checking for suffix of object files... o
checking whether we are using the GNU C compiler... yes
checking whether gcc accepts -g... yes
checking for gcc option to accept ISO C89... none needed
checking whether gcc understands -c and -o together... yes
checking how to run the C preprocessor... gcc -E
checking for grep that handles long lines and -e... /bin/grep
checking for egrep... /bin/grep -E
checking for ANSI C header files... yes
checking for sys/types.h... yes
checking for sys/stat.h... yes
checking for stdlib.h... yes
checking for string.h... yes
```

Рисунок 10 – Запуск ./configure



```
Terminal - vladislav@DESKTOP-BMJQ5IR: ~/Projects/SystemProgramming/0x0A/Lab_05
File Edit View Terminal Tabs Help
checking whether build environment is sane... yes
checking for a thread-safe mkdir -p... /bin/mkdir -p
checking for gawk... no
checking for mawk... mawk
checking whether make sets $(MAKE)... yes
checking whether make supports the include directive... yes (GNU style)
checking whether make supports nested variables... yes
checking dependency style of gcc... gcc3
checking for ranlib... ranlib
checking that generated files are newer than configure... done
configure: creating ./config.status
config.status: creating build/Makefile
config.status: creating Makefile
config.status: executing depfiles commands
vladislav@DESKTOP-BMJQ5IR:~/Projects/SystemProgramming/0x0A/Lab_05$ make
Making all in build
make[1]: Entering directory '/home/vladislav/Projects/SystemProgramming/0x0A/Lab_05/build'
gcc -DPACKAGE_NAME=\"Lab_05\" -DPACKAGE_TARNAME=\"lab_05\" -DPACKAGE_VERSION=\"3.0\" -DPACKAGE_STRING=\"Lab_05 3.0\" -DPACKAGE_BUGREPORT
=\"misterptits@yandex.ru\" -DPACKAGE_URL=\"\" -DSTDC_HEADERS=1 -DHAVE_SYS_TYPES_H=1 -DHAVE_SYS_STAT_H=1 -DHAVE_STRING_H=1 -DHAVE_MEMORY_H=1 -DHAVE_STRINGS_H=1 -DHAVE_INTTYPES_H=1 -DHAVE_STDINT_H=1 -DHAVE_UNISTD_H=1 -DHAVE_ARPA_INET_H=1 -DHAVE_FCNTL_H=1 -DHAVE_LIMITS_H=1 -DHAVE_MALLOC_H=1 -DHAVE_NETINET_IN_H=1 -DHAVE_STDDEF_H=1 -DHAVE_STDINT_H=1 -DHAVE_STDLIB_H=1 -DHAVE_STRING_H=1 -DHAVE_SYS_SOCKET_H=1 -DHAVE_UNISTD_H=1 -DHAVE_BOOL_H=1 -DHAVE_STDLIB_H=1 -DHAVE_MALLOC_H=1 -DHAVE_REALLOC_H=1 -DHAVE_DECL_STRERROR_R=1 -DHAVE_STRERROR_R=1 -DHAVE_SOCKET_H=1 -DHAVE_STRCHR=1 -DPACKAGE=\"Lab_05\" -DVERSION=\"3.0\" -I. -I../Lab_05 MatrixLib -I../Lab_05 Lib
-std-gnu99 -g -O2 -MT ../Lab_05_Client/Lab_05_Client-ClientArgs.o -MD -MP -MF ../Lab_05_Client/deps/Lab_05_Client-ClientArgs.Tpo -c -o
../Lab_05_Client/Lab_05_Client-ClientArgs.o `test -f ../Lab_05_Client/ClientArgs.c` || echo `./../Lab_05_Client/ClientArgs.c
mv -f ../Lab_05_Client/deps/Lab_05_Client-ClientArgs.Tpo ../Lab_05_Client/deps/Lab_05_Client-ClientArgs.Po
gcc -DPACKAGE_NAME=\"Lab_05\" -DPACKAGE_TARNAME=\"lab_05\" -DPACKAGE_VERSION=\"3.0\" -DPACKAGE_STRING=\"Lab_05 3.0\" -DPACKAGE_BUGREPORT
```

Рисунок 11 – Конец работы ./configure и запуск make

```
Terminal - vladislav@DESKTOP-BMJQ5IR: ~/Projects/SystemProgramming/0x0A/Lab_05
File Edit View Terminal Tabs Help
../Lab_05_Server/Lab_05_Server-ServerArgs.o `test -f '../Lab_05_Server/ServerArgs.c' || echo './'../Lab_05_Server/ServerArgs.c
mv -f ../Lab_05_Server/.deps/Lab_05_Server-ServerArgs.Tpo ../Lab_05_Server/.deps/Lab_05_Server-ServerArgs.Po
gcc -DPACKAGE_NAME=\"Lab_05\" -DPACKAGE_TARNAME=\"lab_05\" -DPACKAGE_VERSION=\"3.0\" -DPACKAGE_STRING=\"Lab_05 3.0\" -DPACKAGE_BUGREPORT
=\"misterptits@yandex.ru\" -DPACKAGE_URL=\"\" -DSTDC_HEADERS=1 -DHAVE_SYS_TYPES_H=1 -DHAVE_SYS_STAT_H=1 -DHAVE_STDLIB_H=1 -DHAVE_STRING_H
=1 -DHAVE_MEMORY_H=1 -DHAVE_STRINGS_H=1 -DHAVE_INTTYPES_H=1 -DHAVE_STDINT_H=1 -DHAVE_UNISTD_H=1 -DHAVE_ARPA_INET_H=1 -DHAVE_FCNTL_H=1 -DH
AVE_LIMITS_H=1 -DHAVE_MALLOC_H=1 -DHAVE_NETINET_IN_H=1 -DHAVE_STDEDEF_H=1 -DHAVE_STDINT_H=1 -DHAVE_STDLIB_H=1 -DHAVE_STRING_H=1 -DHAVE_SYS
_SOCKET_H=1 -DHAVE_UNISTD_H=1 -DHAVE_BOOL_H=1 -DHAVE_STDLIB_H=1 -DHAVE_MALLOC_H=1 -DHAVE_STDLIB_H=1 -DHAVE_REALLOC_H=1 -DHAVE_DECL_STRERROR_R=
1 -DHAVE_STRERROR_R=1 -DHAVE_SOCKET=1 -DHAVE_STRCHR=1 -DPACKAGE=\"lab_05\" -DVERSION=\"3.0\" -I. -I../Lab_05_MatrixLib -I../Lab_05_Lib
-std-gnu99 -g -O2 -MT ../Lab_05_Server/Lab_05_Server-Server.o -MD -MP -MF ../Lab_05_Server/.deps/Lab_05_Server-Server.Tpo -c -o ../Lab_0
5_Server/Lab_05_Server-Server.o `test -f '../Lab_05_Server/Server.c' || echo './'../Lab_05_Server/Server.c
mv -f ../Lab_05_Server/.deps/Lab_05_Server-Server.Tpo ../Lab_05_Server/.deps/Lab_05_Server-Server.Po
gcc -DPACKAGE_NAME=\"Lab_05\" -DPACKAGE_TARNAME=\"lab_05\" -DPACKAGE_VERSION=\"3.0\" -DPACKAGE_STRING=\"Lab_05 3.0\" -DPACKAGE_BUGREPORT
=\"misterptits@yandex.ru\" -DPACKAGE_URL=\"\" -DSTDC_HEADERS=1 -DHAVE_SYS_TYPES_H=1 -DHAVE_SYS_STAT_H=1 -DHAVE_STDLIB_H=1 -DHAVE_STRING_H
=1 -DHAVE_MEMORY_H=1 -DHAVE_STRINGS_H=1 -DHAVE_INTTYPES_H=1 -DHAVE_STDINT_H=1 -DHAVE_UNISTD_H=1 -DHAVE_ARPA_INET_H=1 -DHAVE_FCNTL_H=1 -DH
AVE_LIMITS_H=1 -DHAVE_MALLOC_H=1 -DHAVE_NETINET_IN_H=1 -DHAVE_STDEDEF_H=1 -DHAVE_STDINT_H=1 -DHAVE_STDLIB_H=1 -DHAVE_STRING_H=1 -DHAVE_SYS
_SOCKET_H=1 -DHAVE_UNISTD_H=1 -DHAVE_BOOL_H=1 -DHAVE_STDLIB_H=1 -DHAVE_MALLOC_H=1 -DHAVE_STDLIB_H=1 -DHAVE_REALLOC_H=1 -DHAVE_DECL_STRERROR_R=
1 -DHAVE_STRERROR_R=1 -DHAVE_SOCKET=1 -DHAVE_STRCHR=1 -DPACKAGE=\"lab_05\" -DVERSION=\"3.0\" -I. -I../Lab_05_MatrixLib -I../Lab_05_Lib
-std-gnu99 -g -O2 -MT ../Lab_05_Server/Lab_05_Server-main.o -MD -MP -MF ../Lab_05_Server/.deps/Lab_05_Server-main.Tpo -c -o ../Lab_05_Se
rver/Lab_05_Server-main.o `test -f '../Lab_05_Server/main.c' || echo './'../Lab_05_Server/main.c
mv -f ../Lab_05_Server/.deps/Lab_05_Server-main.Tpo ../Lab_05_Server/.deps/Lab_05_Server-main.Po
gcc -I../Lab_05_MatrixLib -I../Lab_05_Lib -std-gnu99 -g -O2 -o Lab_05_Server ../Lab_05_Server/Lab_05_Server-ServerArgs.o ../Lab_05_Serv
er/Lab_05_Server-Server.o ../Lab_05_Server/Lab_05_Server-main.o libLab_05_MatrixLib.a libLab_05_Lib.a
make[1]: Leaving directory '/home/vladislav/Projects/SystemProgramming/0x0A/Lab_05/build'
make[1]: Entering directory '/home/vladislav/Projects/SystemProgramming/0x0A/Lab_05'
make[1]: Nothing to be done for 'all-am'.
make[1]: Leaving directory '/home/vladislav/Projects/SystemProgramming/0x0A/Lab_05'
vladislav@DESKTOP-BMJQ5IR:~/Projects/SystemProgramming/0x0A/Lab_05$
```

Рисунок 12 – Конец работы make

4.2.2. Сборка на клиенте с помощью CMake и Ninja

```
PowerShell 6 (x64)
PS C:\Users\vladislav\Projects\SystemProgramming\0x0A\Lab_05> mkdir buildcmake

Directory: C:\Users\vladislav\Projects\SystemProgramming\0x0A\Lab_05

Mode                LastWriteTime         Length Name
----                -
d-----            24.11.2019    23:57         buildcmake

PS C:\Users\vladislav\Projects\SystemProgramming\0x0A\Lab_05> cd buildcmake
PS C:\Users\vladislav\Projects\SystemProgramming\0x0A\Lab_05\buildcmake> cmake -G "Ninja" -DCMAKE_C_COMPILER=clang -DCMAKE
_CXX_COMPILER=clang++ -DCMAKE_RC_COMPILER=llvm-rc ...
-- The C compiler identification is Clang 9.0.0 with GNU-like command-line
-- The CXX compiler identification is Clang 9.0.0 with GNU-like command-line
-- Check for working C compiler: C:/Program Files/LLVM/bin/clang.exe -- works
-- Detecting C compiler ABI info
-- Detecting C compiler ABI info - done
-- Detecting C compile features
-- Detecting C compile features - done
-- Check for working CXX compiler: C:/Program Files/LLVM/bin/clang++.exe
-- Check for working CXX compiler: C:/Program Files/LLVM/bin/clang++.exe -- works
-- Detecting CXX compiler ABI info
-- Detecting CXX compiler ABI info - done
-- Detecting CXX compile features
-- Detecting CXX compile features - done
-- Configuring done
-- Generating done
-- Build files have been written to: C:\Users\vladislav\Projects\SystemProgramming\0x0A\Lab_05\buildcmake
```

Рисунок 13 – Запуск cmake

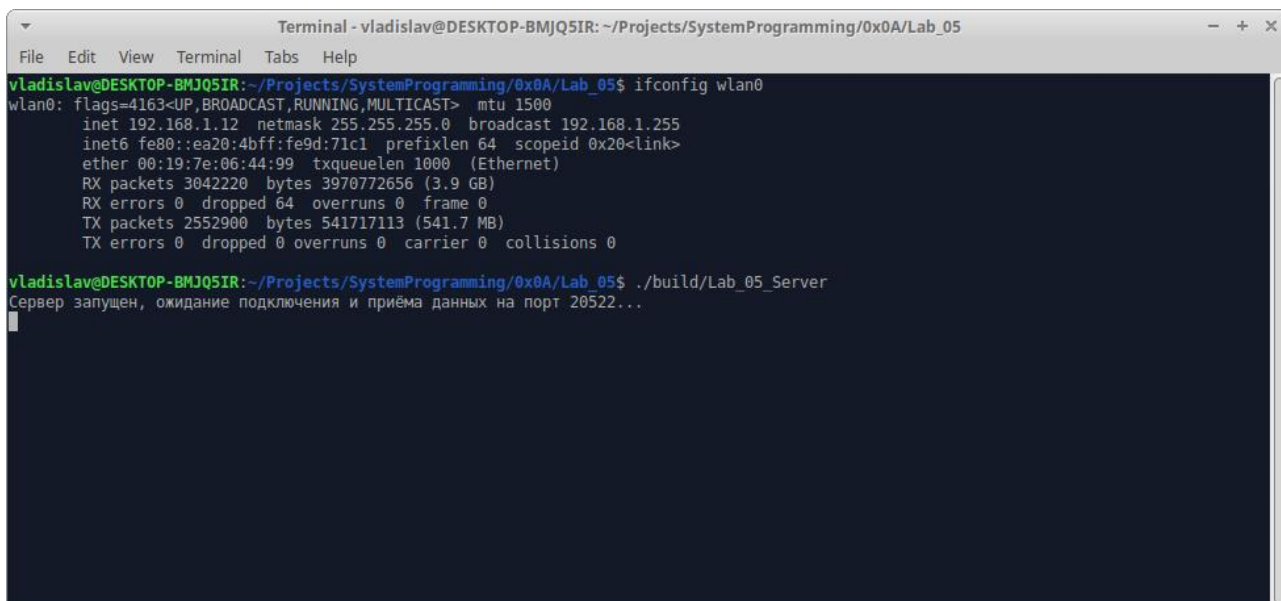

```
PowerShell 6 (x64)
-- Detecting CXX compile features
-- Detecting CXX compile features - done
-- Configuring done
-- Generating done
-- Build files have been written to: C:/Users/vladislav/Projects/SystemProgramming/0x0A/Lab_05/buildcmake
PS C:\Users\vladislav\Projects\SystemProgramming\0x0A\Lab_05\buildcmake> ninja
[1/20] Building C object getopt-from-mingw/CMakeFiles/getopt-from-mingw.dir/getopt.c.obj
../getopt-from-mingw/getopt.c:348:28: warning: 'getenv' is deprecated: This function or variable may be unsafe. Consider
using _dupenv_s instead. To disable deprecation, use _CRT_SECURE_NO_WARNINGS. See online help for details. [-Wdeprecate
d-declarations]
    posixly_correct = (getenv("POSIXLY_CORRECT") != NULL);
                        ^
C:\Program Files (x86)\Windows Kits\10\Include\10.0.18362.0\ucrt\stdlib.h:1190:20: note: 'getenv' has been explicitly ma
rked deprecated here
    _Check_return_ ^ _CRT_INSECURE_DEPRECATE(_dupenv_s)
                        ^
C:\Program Files (x86)\Microsoft Visual Studio\2019\Preview\VC\Tools\MSVC\14.24.28207\include\vcruntime.h:311:55: note:
expanded from macro '_CRT_INSECURE_DEPRECATE'
    #define _CRT_INSECURE_DEPRECATE(_Replacement) _CRT_DEPRECATED_TEXT( \
                        ^
C:\Program Files (x86)\Microsoft Visual Studio\2019\Preview\VC\Tools\MSVC\14.24.28207\include\vcruntime.h:301:47: note:
expanded from macro '_CRT_DEPRECATED_TEXT'
    #define _CRT_DEPRECATED_TEXT(_Text) __declspec(deprecated(_Text))
                        ^
1 warning generated.
[4/20] Building C object Lab_05_Client/CMakeFiles/Lab_05_Client.dir/Client.c.obj
../Lab_05_Client/Client.c:34:28: warning: 'inet_addr' is deprecated: Use inet_pton() or InetPton() instead or define _WI
NSOCK_DEPRECATED_NO_WARNINGS to disable deprecated API warnings [-Wdeprecated-declarations]
    name.sin_addr.s_addr = inet_addr(pArgs->IpAddress);
                           ^
```

Рисунок 14 – Запуск ninja

```
PowerShell 6 (x64)
    strcpy(pArgs->IpAddress, optarg);
    ^
C:\Program Files (x86)\Windows Kits\10\Include\10.0.18362.0\ucrt\string.h:133:1: note: 'strcpy' has been explicitly mark
ed deprecated here
    __DEFINE_CPP_OVERLOAD_STANDARD_FUNC_0_1(
    ^
C:\Program Files (x86)\Windows Kits\10\Include\10.0.18362.0\ucrt\corecrt.h:748:5: note: expanded from macro '__DEFINE_CP
P_OVERLOAD_STANDARD_FUNC_0_1'
    __DEFINE_CPP_OVERLOAD_STANDARD_FUNC_0_1_EX(_ReturnType, _ReturnPolicy, _DeclSpec, _FuncName, _FuncName##_s, _DstType
, _SaAttributeDst, _DstType, _Dst, _TType1, _TArg1)
    ^
C:\Program Files (x86)\Windows Kits\10\Include\10.0.18362.0\ucrt\corecrt.h:1831:17: note: expanded from macro '__DEFINE_
CPP_OVERLOAD_STANDARD_FUNC_0_1_EX'
    _CRT_INSECURE_DEPRECATE(_SecureFuncName) _DeclSpec _ReturnType __cdecl _FuncName(_SaAttributeDst _DstType
pe *_Dst, _TType1 _TArg1);
    ^
C:\Program Files (x86)\Microsoft Visual Studio\2019\Preview\VC\Tools\MSVC\14.24.28207\include\vcruntime.h:311:55: note:
expanded from macro '_CRT_INSECURE_DEPRECATE'
    #define _CRT_INSECURE_DEPRECATE(_Replacement) _CRT_DEPRECATED_TEXT( \
    ^
C:\Program Files (x86)\Microsoft Visual Studio\2019\Preview\VC\Tools\MSVC\14.24.28207\include\vcruntime.h:301:47: note:
expanded from macro '_CRT_DEPRECATED_TEXT'
    #define _CRT_DEPRECATED_TEXT(_Text) __declspec(deprecated(_Text))
    ^
1 warning generated.
[20/20] Linking C executable Lab_05_Server\Lab_05_Server.exe
PS C:\Users\vladislav\Projects\SystemProgramming\0x0A\Lab_05\buildcmake> .
```

Рисунок 15 – Конец работы ninja

4.2.3. Запуск сервера

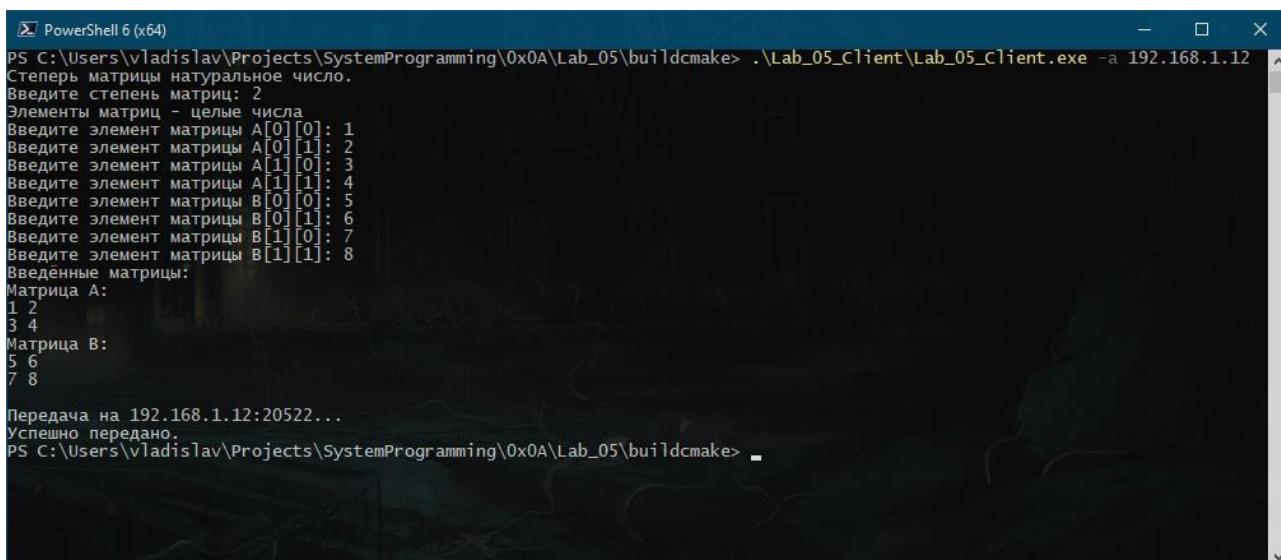


```
Terminal - vladislav@DESKTOP-BMJQ5IR: ~/Projects/SystemProgramming/0x0A/Lab_05
File Edit View Terminal Tabs Help
vladislav@DESKTOP-BMJQ5IR:~/Projects/SystemProgramming/0x0A/Lab_05$ ifconfig wlan0
wlan0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 192.168.1.12 netmask 255.255.255.0 broadcast 192.168.1.255
    inet6 fe80::ea20:4bff:fe9d:71c1 prefixlen 64 scopeid 0x20<link>
    ether 00:19:7e:06:44:90 txqueuelen 1000 (Ethernet)
    RX packets 3042220 bytes 3970772656 (3.9 GB)
    RX errors 0 dropped 64 overruns 0 frame 0
    TX packets 2552900 bytes 541717113 (541.7 MB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

vladislav@DESKTOP-BMJQ5IR:~/Projects/SystemProgramming/0x0A/Lab_05$ ./build/Lab_05_Server
Сервер запущен, ожидание подключения и приёма данных на порт 20522...
```

Рисунок 16 – Запуск ifconfig для получения IP-адреса сервера в локальной сети и запуск сервера

4.2.4. Запуск клиента

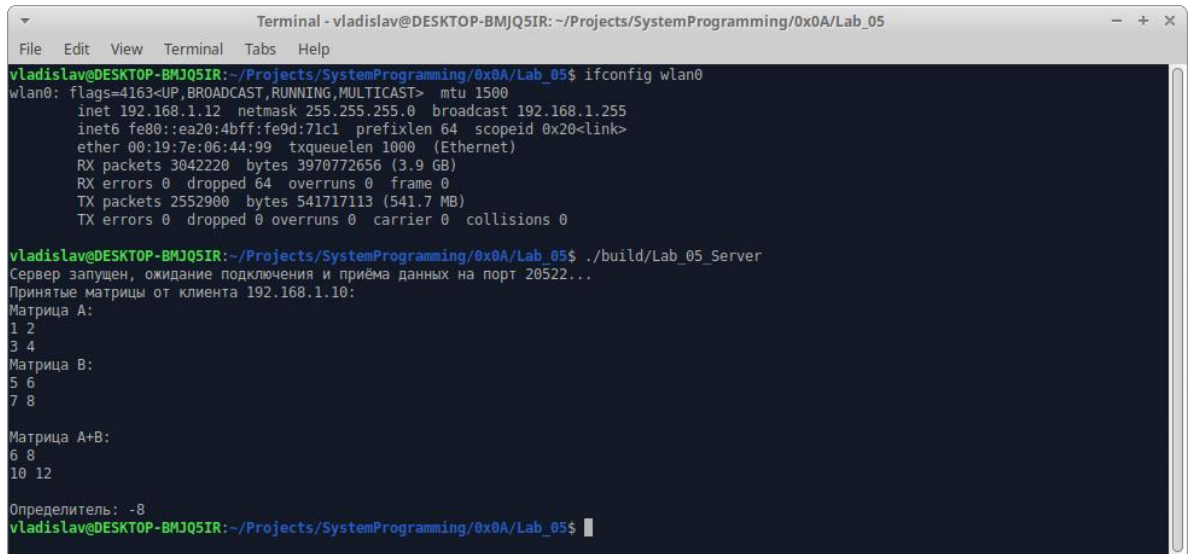


```
PowerShell 6 (x64)
PS C:\Users\vladislav\Projects\SystemProgramming\0x0A\Lab_05\buildcmake> .\Lab_05_Client\Lab_05_Client.exe -a 192.168.1.12
Степерь матрицы натуральное число.
Введите степень матриц: 2
Элементы матриц - целые числа
Введите элемент матрицы A[0][0]: 1
Введите элемент матрицы A[0][1]: 2
Введите элемент матрицы A[1][0]: 3
Введите элемент матрицы A[1][1]: 4
Введите элемент матрицы B[0][0]: 5
Введите элемент матрицы B[0][1]: 6
Введите элемент матрицы B[1][0]: 7
Введите элемент матрицы B[1][1]: 8
Введённые матрицы:
Матрица A:
1 2
3 4
Матрица B:
5 6
7 8

Передача на 192.168.1.12:20522...
Успешно передано.
PS C:\Users\vladislav\Projects\SystemProgramming\0x0A\Lab_05\buildcmake>
```

Рисунок 17 – Запуск клиента

4.2.5. Результат работы сервера



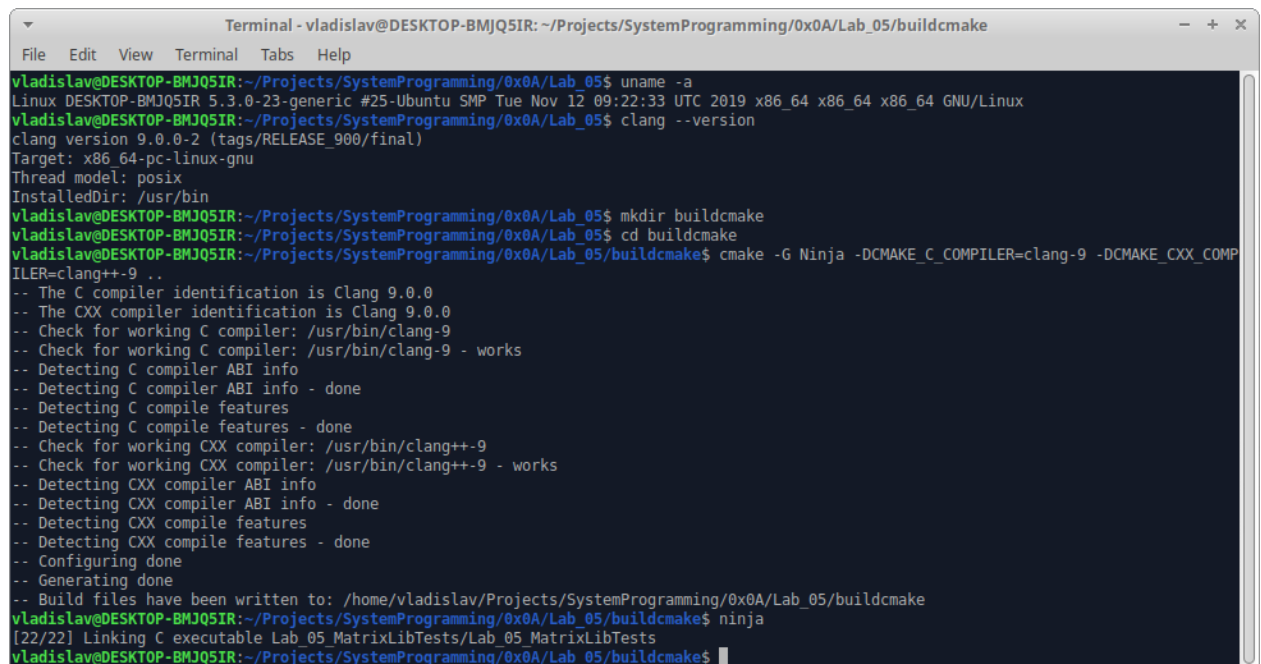
```
Terminal - vladislav@DESKTOP-BMJQ5IR: ~/Projects/SystemProgramming/0x0A/Lab_05
File Edit View Terminal Tabs Help
vladislav@DESKTOP-BMJQ5IR:~/Projects/SystemProgramming/0x0A/Lab_05$ ifconfig wlan0
wlan0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 192.168.1.12 netmask 255.255.255.0 broadcast 192.168.1.255
    inet6 fe80::ea20:4bff:fe0d:71c1 prefixlen 64 scopeid 0x20<link>
    ether 00:19:7e:06:44:99 txqueuelen 1000 (Ethernet)
    RX packets 3042220 bytes 3970772656 (3.9 GB)
    RX errors 0 dropped 64 overruns 0 frame 0
    TX packets 2552900 bytes 541717113 (541.7 MB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

vladislav@DESKTOP-BMJQ5IR:~/Projects/SystemProgramming/0x0A/Lab_05$ ./build/Lab_05_Server
Сервер запущен, ожидание подключения и приёма данных на порт 20522...
Принятые матрицы от клиента 192.168.1.10:
Матрица A:
1 2
3 4
Матрица B:
5 6
7 8
Матрица A+B:
6 8
10 12
Определитель: -8
vladislav@DESKTOP-BMJQ5IR:~/Projects/SystemProgramming/0x0A/Lab_05$
```

Рисунок 18 – Результат работы сервера

4.3 Запуск №3 (по виртуальной сети; сервер – Android (Termix), Clang; клиент – Ubuntu 19.10, Clang)


4.3.1. Сборка с помощью CMake и Ninja на клиенте



```
Terminal - vladislav@DESKTOP-BMJQ5IR: ~/Projects/SystemProgramming/0x0A/Lab_05/buildcmake
File Edit View Terminal Tabs Help
vladislav@DESKTOP-BMJQ5IR:~/Projects/SystemProgramming/0x0A/Lab_05$ uname -a
Linux DESKTOP-BMJQ5IR 5.3.0-23-generic #25-Ubuntu SMP Tue Nov 12 09:22:33 UTC 2019 x86_64 x86_64 x86_64 GNU/Linux
vladislav@DESKTOP-BMJQ5IR:~/Projects/SystemProgramming/0x0A/Lab_05$ clang --version
clang version 9.0.0-2 (tags/RELEASE_900/final)
Target: x86_64-pc-linux-gnu
Thread model: posix
InstalledDir: /usr/bin
vladislav@DESKTOP-BMJQ5IR:~/Projects/SystemProgramming/0x0A/Lab_05$ mkdir buildcmake
vladislav@DESKTOP-BMJQ5IR:~/Projects/SystemProgramming/0x0A/Lab_05$ cd buildcmake
vladislav@DESKTOP-BMJQ5IR:~/Projects/SystemProgramming/0x0A/Lab_05/buildcmake$ cmake -G Ninja -DCMAKE_C_COMPILER=clang-9 -DCMAKE_CXX_COMPILER=clang++-9 ..
-- The C compiler identification is Clang 9.0.0
-- The CXX compiler identification is Clang 9.0.0
-- Check for working C compiler: /usr/bin/clang-9
-- Check for working C compiler: /usr/bin/clang-9 - works
-- Detecting C compiler ABI info
-- Detecting C compiler ABI info - done
-- Detecting C compile features
-- Detecting C compile features - done
-- Check for working CXX compiler: /usr/bin/clang++-9
-- Check for working CXX compiler: /usr/bin/clang++-9 - works
-- Detecting CXX compiler ABI info
-- Detecting CXX compiler ABI info - done
-- Detecting CXX compile features
-- Detecting CXX compile features - done
-- Configuring done
-- Generating done
-- Build files have been written to: /home/vladislav/Projects/SystemProgramming/0x0A/Lab_05/buildcmake
vladislav@DESKTOP-BMJQ5IR:~/Projects/SystemProgramming/0x0A/Lab_05/buildcmake$ ninja
[22/22] Linking C executable Lab_05_MatrixLibTests/Lab_05_MatrixLibTests
vladislav@DESKTOP-BMJQ5IR:~/Projects/SystemProgramming/0x0A/Lab_05/buildcmake$
```

Рисунок 19 – Запуск cmake и ninja

4.3.2. Сборка с помощью autotools на сервере



```
00:22:49 00:22:49 19%
$ uname -a
Linux localhost 4.9.106-perf+ #1 SMP PREEMPT Wed Sep 11 23:46:
35 CST 2019 aarch64 Android
$ clang --version
clang version 9.0.0 (tags/RELEASE_900/final)
Target: aarch64-unknown-linux-android
Thread model: posix
InstalledDir: /data/data/com.termux/files/usr/bin
$ ./configure CC=clang
checking for gcc... clang
checking whether the C compiler works... yes
checking for C compiler default output file name... a.out
checking for suffix of executables...
checking whether we are cross compiling... no
checking for suffix of object files... o
checking whether we are using the GNU C compiler... yes
checking whether clang accepts -g... yes
checking for clang option to accept ISO C89... none needed
checking whether clang understands -c and -o together... yes
checking how to run the C preprocessor... clang -E
checking for grep that handles long lines and -e... /data/data
/com.termux/files/usr/bin/grep
checking for egrep... /data/data/com.termux/files/usr/bin/grep
-E
checking for ANSI C header files... yes
checking for sys/types.h... yes
checking for sys/stat.h... yes
checking for stdlib.h... yes
checking for string.h... yes
checking for memory.h... yes
checking for strings.h... yes
checking for inttypes.h... yes
checking for stdint.h... yes
checking for unistd.h... yes
checking arpa/inet.h usability... yes
checking arpa/inet.h presence... yes
checking for arpa/inet.h... yes
checking fcntl.h usability... yes
checking fcntl.h presence... yes
checking for fcntl.h... yes
checking limits.h usability... yes
checking limits.h presence... yes
checking for limits.h... yes
checking malloc.h usability... yes
checking malloc.h presence... yes
checking for malloc.h... yes
checking netinet/in.h usability... yes
checking netinet/in.h presence... yes
checking for netinet/in.h... yes
checking stddef.h usability... yes
checking stddef.h presence... yes
checking for stddef.h... yes
checking for stdint.h... (cached) yes
checking for stdlib.h... (cached) yes
checking for string.h... (cached) yes
checking sys/socket.h usability... yes
checking sys/socket.h presence... yes
checking for sys/socket.h... yes
checking for unistd.h... (cached) yes
checking for stdbool.h that conforms to C99... yes
checking for _Bool... yes
checking for size_t... yes
checking for uint16_t... yes
```

ESC CTRL ALT — ↓ ↑

Рисунок 20 – Запуск ./configure

```
00:40:54 🎵 📺 🔌 56% 🔋

/files/usr/bin/install -c
checking whether build environment is sane... yes
checking for a thread-safe mkdir -p... /data/data/com.termux/f
iles/usr/bin/mkdir -p
checking for gawk... gawk
checking whether make sets $(MAKE)... yes
checking whether make supports the include directive... yes (G
NU style)
checking whether make supports nested variables... yes
checking dependency style of gcc... gcc3
checking for ranlib... ranlib
checking that generated files are newer than configure... done
configure: creating ./config.status
config.status: creating build/Makefile
config.status: creating Makefile
config.status: executing depfiles commands
$ make
Making all in build
make[1]: Entering directory '/data/data/com.termux/files/home/
Projects/SystemProgramming/0x0A/Lab_05/build'
gcc -DPACKAGE_NAME=\"Lab_05\" -DPACKAGE_TARNAME=\"lab_05\" -DP
ACKAGE_VERSION=\"3.0\" -DPACKAGE_STRING=\"Lab_05 3.0\" -DPACK
AGE_BUGREPORT=\"misterptits@yandex.ru\" -DPACKAGE_URL=\"\" -DS
TDC_HEADERS=1 -DHAVE_SYS_TYPES_H=1 -DHAVE_SYS_STAT_H=1 -DHAVE_
STDLIB_H=1 -DHAVE_STRING_H=1 -DHAVE_MEMORY_H=1 -DHAVE_STRINGS_
H=1 -DHAVE_INTTYPES_H=1 -DHAVE_STDINT_H=1 -DHAVE_UNISTD_H=1 -D
HAVE_ARPA_INET_H=1 -DHAVE_FCNTL_H=1 -DHAVE_LIMITS_H=1 -DHAVE_M
ALLOC_H=1 -DHAVE_NETINET_IN_H=1 -DHAVE_STDDEF_H=1 -DHAVE_STDI
N_H=1 -DHAVE_STDLIB_H=1 -DHAVE_STRING_H=1 -DHAVE_SYS_SOCKET_H=
1 -DHAVE_UNISTD_H=1 -DHAVE__BOOL=1 -DHAVE_STDLIB_H=1 -DHAVE_MA
LLOC=1 -DHAVE_STDLIB_H=1 -DHAVE_REALLOC=1 -DHAVE_DECL_STRERROR
_R=1 -DHAVE_STRERROR_R=1 -DHAVE_SOCKET=1 -DHAVE_STRCHR=1 -DPAC
KAGE=\"lab_05\" -DVERSION=\"3.0\" -I. -I../Lab_05_MatrixLib
-I../Lab_05_Lib -std=gnu99 -g -O2 -MT ../Lab_05_Client/Lab_05
_Client-ClientArgs.o -MD -MP -MF ../Lab_05_Client/.deps/Lab_05
_Client-ClientArgs.Tpo -c -o ../Lab_05_Client/Lab_05_Client-Cl
ientArgs.o `test -f '../Lab_05_Client/ClientArgs.c' || echo '.
/'`../Lab_05_Client/ClientArgs.c
mv -f ../Lab_05_Client/.deps/Lab_05_Client-ClientArgs.Tpo ../L
ab_05_Client/.deps/Lab_05_Client-ClientArgs.Po
gcc -DPACKAGE_NAME=\"Lab_05\" -DPACKAGE_TARNAME=\"lab_05\" -DP
ACKAGE_VERSION=\"3.0\" -DPACKAGE_STRING=\"Lab_05 3.0\" -DPACK
AGE_BUGREPORT=\"misterptits@yandex.ru\" -DPACKAGE_URL=\"\" -DS
TDC_HEADERS=1 -DHAVE_SYS_TYPES_H=1 -DHAVE_SYS_STAT_H=1 -DHAVE_
STDLIB_H=1 -DHAVE_STRING_H=1 -DHAVE_MEMORY_H=1 -DHAVE_STRINGS_
H=1 -DHAVE_INTTYPES_H=1 -DHAVE_STDINT_H=1 -DHAVE_UNISTD_H=1 -D
HAVE_ARPA_INET_H=1 -DHAVE_FCNTL_H=1 -DHAVE_LIMITS_H=1 -DHAVE_M
ALLOC_H=1 -DHAVE_NETINET_IN_H=1 -DHAVE_STDDEF_H=1 -DHAVE_STDI
N_H=1 -DHAVE_STDLIB_H=1 -DHAVE_STRING_H=1 -DHAVE_SYS_SOCKET_H=
1 -DHAVE_UNISTD_H=1 -DHAVE__BOOL=1 -DHAVE_STDLIB_H=1 -DHAVE_MA
LLOC=1 -DHAVE_STDLIB_H=1 -DHAVE_REALLOC=1 -DHAVE_DECL_STRERROR
_R=1 -DHAVE_STRERROR_R=1 -DHAVE_SOCKET=1 -DHAVE_STRCHR=1 -DPAC
KAGE=\"lab_05\" -DVERSION=\"3.0\" -I. -I../Lab_05_MatrixLib
-I../Lab_05_Lib -std=gnu99 -g -O2 -MT ../Lab_05_Client/Lab_05
_Client-Client.o -MD -MP -MF ../Lab_05_Client/.deps/Lab_05_Cli
ent-Client.Tpo -c -o ../Lab_05_Client/Lab_05_Client-Client.o `
test -f '../Lab_05_Client/Client.c' || echo './'`../Lab_05_Cli
ent/Client.c
mv -f ../Lab_05_Client/.deps/Lab_05_Client-Client.Tpo ../Lab_0
5_Client/.deps/Lab_05_Client-Client.Po
gcc -DPACKAGE_NAME=\"Lab_05\" -DPACKAGE_TARNAME=\"lab_05\" -DP
ACKAGE_VERSION=\"3.0\" -DPACKAGE_STRING=\"Lab_05 3.0\" -DPACK
AGE_BUGREPORT=\"misterptits@yandex.ru\" -DPACKAGE_URL=\"\" -DS
```

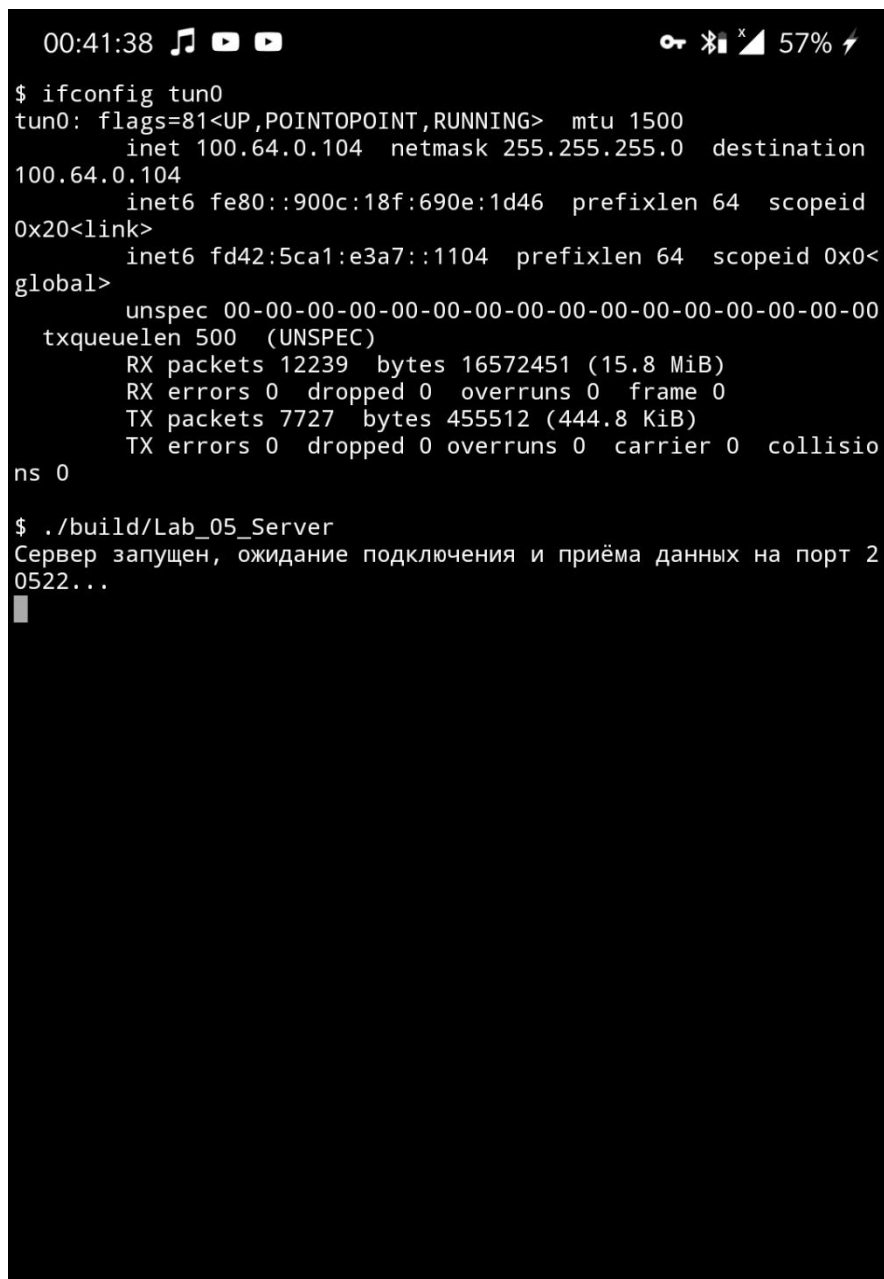
ESC ⌨ CTRL ALT — ↓ ↑

Рисунок 21 – Запуск make

```
00:41:02 56%
1 -DHAVE_UNISTD_H=1 -DHAVE_BOOL=1 -DHAVE_STDLIB_H=1 -DHAVE_MALLO
LLOC=1 -DHAVE_STDLIB_H=1 -DHAVE_REALLOC=1 -DHAVE_DECL_STRERROR
_R=1 -DHAVE_STRERROR_R=1 -DHAVE_SOCKET=1 -DHAVE_STRCHR=1 -DPAC
KAGE="lab_05\" -DVERSION="3.0\" -I. -I../Lab_05_MatrixLib
-I../Lab_05_Lib -std=gnu99 -g -O2 -MT ../Lab_05_Server/Lab_05
_Server-ServerArgs.o -MD -MP -MF ../Lab_05_Server/.deps/Lab_05
_Server-ServerArgs.Tpo -c -o ../Lab_05_Server/Lab_05_Server-Se
rverArgs.o `test -f ../Lab_05_Server/ServerArgs.c` || echo '.
/'`../Lab_05_Server/ServerArgs.c
mv -f ../Lab_05_Server/.deps/Lab_05_Server-ServerArgs.Tpo ../L
ab_05_Server/.deps/Lab_05_Server-ServerArgs.Po
gcc -DPACKAGE_NAME="Lab_05\" -DPACKAGE_TARNAME="lab_05\" -DP
ACKAGE_VERSION="3.0\" -DPACKAGE_STRING="Lab_05\ 3.0\" -DPACK
AGE_BUGREPORT="misterptits@yandex.ru\" -DPACKAGE_URL="" -DS
TDC_HEADERS=1 -DHAVE_SYS_TYPES_H=1 -DHAVE_SYS_STAT_H=1 -DHAVE
_STDLIB_H=1 -DHAVE_STRING_H=1 -DHAVE_MEMORY_H=1 -DHAVE_STRINGS
_H=1 -DHAVE_INTTYPES_H=1 -DHAVE_STDINT_H=1 -DHAVE_UNISTD_H=1 -D
HAVE_ARPA_INET_H=1 -DHAVE_FCNTL_H=1 -DHAVE_LIMITS_H=1 -DHAVE_M
ALLOC_H=1 -DHAVE_NETINET_IN_H=1 -DHAVE_STDDEF_H=1 -DHAVE_STDI
N_T_H=1 -DHAVE_STDLIB_H=1 -DHAVE_STRING_H=1 -DHAVE_SYS_SOCKET_H=
1 -DHAVE_UNISTD_H=1 -DHAVE_BOOL=1 -DHAVE_STDLIB_H=1 -DHAVE_MAL
LOC=1 -DHAVE_STDLIB_H=1 -DHAVE_REALLOC=1 -DHAVE_DECL_STRERROR
_R=1 -DHAVE_STRERROR_R=1 -DHAVE_SOCKET=1 -DHAVE_STRCHR=1 -DPAC
KAGE="lab_05\" -DVERSION="3.0\" -I. -I../Lab_05_MatrixLib
-I../Lab_05_Lib -std=gnu99 -g -O2 -MT ../Lab_05_Server/Lab_05
_Server-Server.o -MD -MP -MF ../Lab_05_Server/.deps/Lab_05_Ser
ver-Server.Tpo -c -o ../Lab_05_Server/Lab_05_Server-Server.o `
test -f ../Lab_05_Server/Server.c` || echo './`../Lab_05_Ser
ver/Server.c
mv -f ../Lab_05_Server/.deps/Lab_05_Server-Server.Tpo ../Lab_0
5_Server/.deps/Lab_05_Server-Server.Po
gcc -DPACKAGE_NAME="Lab_05\" -DPACKAGE_TARNAME="lab_05\" -DP
ACKAGE_VERSION="3.0\" -DPACKAGE_STRING="Lab_05\ 3.0\" -DPACK
AGE_BUGREPORT="misterptits@yandex.ru\" -DPACKAGE_URL="" -DS
TDC_HEADERS=1 -DHAVE_SYS_TYPES_H=1 -DHAVE_SYS_STAT_H=1 -DHAVE
_STDLIB_H=1 -DHAVE_STRING_H=1 -DHAVE_MEMORY_H=1 -DHAVE_STRINGS
_H=1 -DHAVE_INTTYPES_H=1 -DHAVE_STDINT_H=1 -DHAVE_UNISTD_H=1 -D
HAVE_ARPA_INET_H=1 -DHAVE_FCNTL_H=1 -DHAVE_LIMITS_H=1 -DHAVE_M
ALLOC_H=1 -DHAVE_NETINET_IN_H=1 -DHAVE_STDDEF_H=1 -DHAVE_STDI
N_T_H=1 -DHAVE_STDLIB_H=1 -DHAVE_STRING_H=1 -DHAVE_SYS_SOCKET_H=
1 -DHAVE_UNISTD_H=1 -DHAVE_BOOL=1 -DHAVE_STDLIB_H=1 -DHAVE_MAL
LOC=1 -DHAVE_STDLIB_H=1 -DHAVE_REALLOC=1 -DHAVE_DECL_STRERROR
_R=1 -DHAVE_STRERROR_R=1 -DHAVE_SOCKET=1 -DHAVE_STRCHR=1 -DPAC
KAGE="lab_05\" -DVERSION="3.0\" -I. -I../Lab_05_MatrixLib
-I../Lab_05_Lib -std=gnu99 -g -O2 -MT ../Lab_05_Server/Lab_05
_Server-main.o -MD -MP -MF ../Lab_05_Server/.deps/Lab_05_Serve
r-main.Tpo -c -o ../Lab_05_Server/Lab_05_Server-main.o `test -
f ../Lab_05_Server/main.c` || echo './`../Lab_05_Server/main
.c
mv -f ../Lab_05_Server/.deps/Lab_05_Server-main.Tpo ../Lab_05
_Server/.deps/Lab_05_Server-main.Po
gcc -I../Lab_05_MatrixLib -I../Lab_05_Lib -std=gnu99 -g -O2
-o Lab_05_Server ../Lab_05_Server/Lab_05_Server-ServerArgs.o .
../Lab_05_Server/Lab_05_Server-Server.o ../Lab_05_Server/Lab_05
_Server-main.o libLab_05_MatrixLib.a libLab_05_Lib.a
make[1]: Leaving directory '/data/data/com.termux/files/home/P
rojects/SystemProgramming/0x0A/Lab_05/build'
make[1]: Entering directory '/data/data/com.termux/files/home/
Projects/SystemProgramming/0x0A/Lab_05'
make[1]: Nothing to be done for 'all-am'.
make[1]: Leaving directory '/data/data/com.termux/files/home/P
rojects/SystemProgramming/0x0A/Lab_05'
$
```

Рисунок 22 – Конец работы make

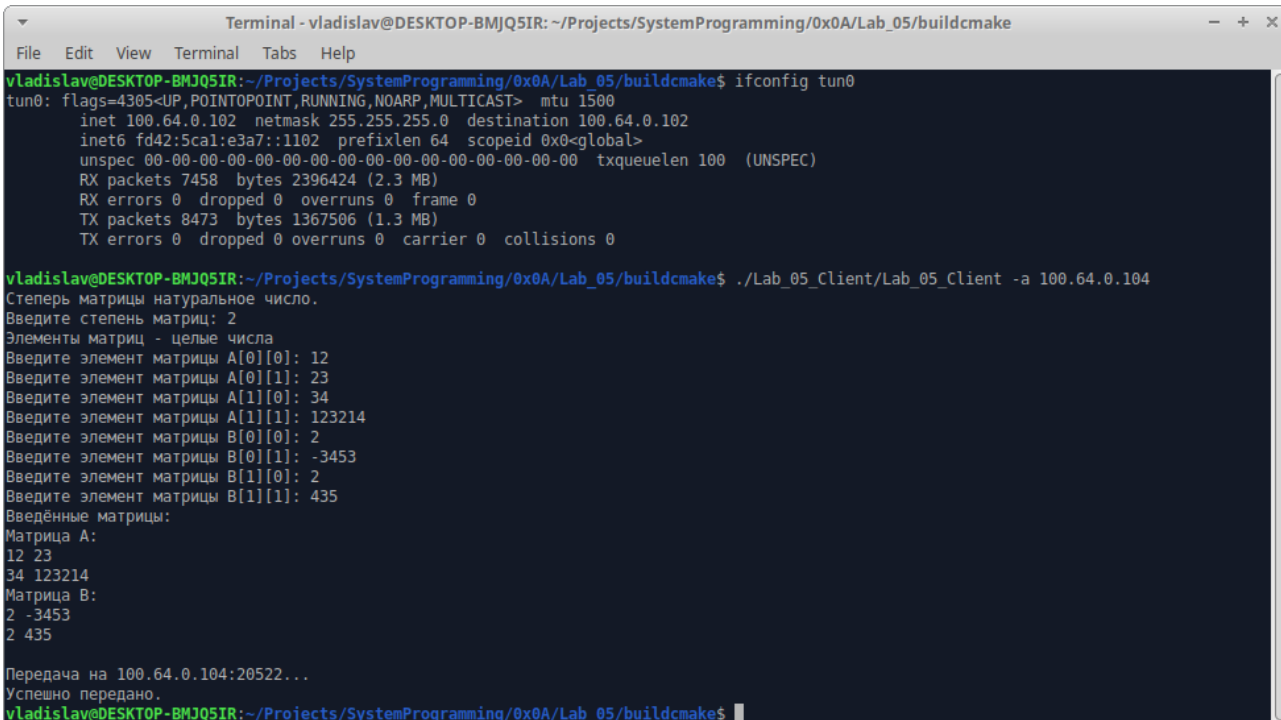
4.3.3. Запуск сервера



```
00:41:38  🎵  📺  📺  🔌  📶  57%  🔋  
$ ifconfig tun0  
tun0: flags=81<UP,POINTOPOINT,RUNNING>  mtu 1500  
      inet 100.64.0.104  netmask 255.255.255.0  destination  
100.64.0.104  
      inet6 fe80::900c:18f:690e:1d46  prefixlen 64  scopeid  
0x20<link>  
      inet6 fd42:5ca1:e3a7::1104  prefixlen 64  scopeid 0x0<  
global>  
      unspec 00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00  
      txqueuelen 500  (UNSPEC)  
      RX packets 12239  bytes 16572451 (15.8 MiB)  
      RX errors 0  dropped 0  overruns 0  frame 0  
      TX packets 7727  bytes 455512 (444.8 KiB)  
      TX errors 0  dropped 0 overruns 0  carrier 0  collisio  
ns 0  
  
$ ./build/Lab_05_Server  
Сервер запущен, ожидание подключения и приёма данных на порт 2  
0522...  
█
```

Рисунок 23 – Запуск `ifconfig` для получения IP-адреса сервера в виртуальной сети и запуск сервера

4.3.4. Запуск клиента



```
Terminal - vladislav@DESKTOP-BMJQ5IR: ~/Projects/SystemProgramming/0x0A/Lab_05/buildcmake
File Edit View Terminal Tabs Help
vladislav@DESKTOP-BMJQ5IR:~/Projects/SystemProgramming/0x0A/Lab_05/buildcmake$ ifconfig tun0
tun0: flags=4305<UP,POINTOPOINT,RUNNING,NOARP,MULTICAST> mtu 1500
    inet 100.64.0.102 netmask 255.255.255.0 destination 100.64.0.102
    inet6 fd42:5ca1:e3a7::1102 prefixlen 64 scopeid 0x0<global>
    unspec 00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00 txqueuelen 100 (UNSPEC)
    RX packets 7458 bytes 2396424 (2.3 MB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 8473 bytes 1367506 (1.3 MB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

vladislav@DESKTOP-BMJQ5IR:~/Projects/SystemProgramming/0x0A/Lab_05/buildcmake$ ./Lab_05_Client/Lab_05_Client -a 100.64.0.104
Степень матрицы натуральное число.
Введите степень матриц: 2
Элементы матриц - целые числа
Введите элемент матрицы A[0][0]: 12
Введите элемент матрицы A[0][1]: 23
Введите элемент матрицы A[1][0]: 34
Введите элемент матрицы A[1][1]: 123214
Введите элемент матрицы B[0][0]: 2
Введите элемент матрицы B[0][1]: -3453
Введите элемент матрицы B[1][0]: 2
Введите элемент матрицы B[1][1]: 435
Введённые матрицы:
Матрица A:
12 23
34 123214
Матрица B:
2 -3453
2 435
Передача на 100.64.0.104:20522...
Успешно передано.
vladislav@DESKTOP-BMJQ5IR:~/Projects/SystemProgramming/0x0A/Lab_05/buildcmake$
```

Рисунок 24 – Клиент считал данные, передал и успешно завершился

4.3.5. Результат работы сервера

```
00:46:17  🎵  📺  📶  64%

$ ifconfig tun0
tun0: flags=81<UP,POINTOPOINT,RUNNING> mtu 1500
    inet 100.64.0.104 netmask 255.255.255.0 destination
100.64.0.104
    inet6 fe80::900c:18f:690e:1d46 prefixlen 64 scopeid
0x20<link>
    inet6 fd42:5ca1:e3a7::1104 prefixlen 64 scopeid 0x0<
global>
    unspec 00-00-00-00-00-00-00-00-00-00-00-00-00-00-00
txqueuelen 500 (UNSPEC)
    RX packets 12341 bytes 16622498 (15.8 MiB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 7824 bytes 474707 (463.5 KiB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisio
ns 0

$ ./build/Lab_05_Server
Сервер запущен, ожидание подключения и приёма данных на порт 2
0522...
Принятые матрицы от клиента 100.64.0.102:
Матрица A:
12 23
34 123214
Матрица B:
2 -3453
2 435

Матрица A+B:
14 -3430
36 123649

Определитель: 1854566
$ █
```

Рисунок 25 – Сервер принял, вычислил, вывел результат и успешно завершился

4.4 Запуск №4 (по глобальной сети; сервер – Ubuntu 16.04, GCC; клиент – Windows 10, MinGW)

4.4.1. Сборка на клиенте с помощью CMake и mingw32-make


```
PowerShell 6 (x64)
PS C:\Users\vladislav\Projects\SystemProgramming\0x0A\Lab_05> mkdir buildcmake

Directory: C:\Users\vladislav\Projects\SystemProgramming\0x0A\Lab_05

Mode                LastWriteTime         Length Name
----                -
d-----           25.11.2019     0:05         buildcmake

PS C:\Users\vladislav\Projects\SystemProgramming\0x0A\Lab_05> cd buildcmake
PS C:\Users\vladislav\Projects\SystemProgramming\0x0A\Lab_05\buildcmake> cmake -G "MinGW Makefiles" ..
-- The C compiler identification is GNU 7.3.0
-- The CXX compiler identification is GNU 7.3.0
-- Check for working C compiler: C:/Qt/Tools/mingw730_64/bin/gcc.exe
-- Check for working C compiler: C:/Qt/Tools/mingw730_64/bin/gcc.exe -- works
-- Detecting C compiler ABI info
-- Detecting C compiler ABI info - done
-- Detecting C compile features
-- Detecting C compile features - done
-- Check for working CXX compiler: C:/Qt/Tools/mingw730_64/bin/g++.exe
-- Check for working CXX compiler: C:/Qt/Tools/mingw730_64/bin/g++.exe -- works
-- Detecting CXX compiler ABI info
-- Detecting CXX compiler ABI info - done
-- Detecting CXX compile features
-- Detecting CXX compile features - done
-- Configuring done
-- Generating done
-- Build files have been written to: C:\Users\vladislav\Projects\SystemProgramming\0x0A\Lab_05\buildcmake
PS C:\Users\vladislav\Projects\SystemProgramming\0x0A\Lab_05\buildcmake> mingw32-make
```

Рисунок 26 – Запуск cmake

```
PowerShell 6 (x64)
-- Detecting C compile features - done
-- Check for working CXX compiler: C:/Qt/Tools/mingw730_64/bin/g++.exe
-- Check for working CXX compiler: C:/Qt/Tools/mingw730_64/bin/g++.exe -- works
-- Detecting CXX compiler ABI info
-- Detecting CXX compiler ABI info - done
-- Detecting CXX compile features
-- Detecting CXX compile features - done
-- Configuring done
-- Generating done
-- Build files have been written to: C:\Users\vladislav\Projects\SystemProgramming\0x0A\Lab_05\buildcmake
PS C:\Users\vladislav\Projects\SystemProgramming\0x0A\Lab_05\buildcmake> mingw32-make
Scanning dependencies of target Lab_05_MatrixLib
[ 5%] Building C object Lab_05_MatrixLib/CMakeFiles/Lab_05_MatrixLib.dir/Matrix.c.obj
[11%] Linking C static library libLab_05_MatrixLib.a
[11%] Built target Lab_05_MatrixLib
Scanning dependencies of target Lab_05_Lib
[16%] Building C object Lab_05_Lib/CMakeFiles/Lab_05_Lib.dir/Utils.c.obj
[22%] Building C object Lab_05_Lib/CMakeFiles/Lab_05_Lib.dir/ReturnCodes.c.obj
[27%] Building C object Lab_05_Lib/CMakeFiles/Lab_05_Lib.dir/Socket.c.obj
[33%] Building C object Lab_05_Lib/CMakeFiles/Lab_05_Lib.dir/Request.c.obj
In file included from C:\Users\vladislav\Projects\SystemProgramming\0x0A\Lab_05\Lab_05_Lib\Request.c:8:0:
C:\Users\vladislav\Projects\SystemProgramming\0x0A\Lab_05\Lab_05_Lib\Request.c: In function 'SendRequest':
C:\Users\vladislav\Projects\SystemProgramming\0x0A\Lab_05\Lab_05_Lib\Request.c:44:24: warning: passing argument 2 of 'send'
from incompatible pointer type [-Wincompatible-pointer-types]
    send(sock, pRequest, sizeof(Request), MSG_NOSIGNAL),
                   ^
C:\Users\vladislav\Projects\SystemProgramming\0x0A\Lab_05\Lab_05_Lib\ReturnCodes.h:56:16: note: in definition of macro 'RETURN_UNSUCCESSFUL_IF_NOT_EQUAL'
    int tmp = (f); \
```

Рисунок 27 – Запуск mingw32-make


```
PowerShell 6 (x64)
[ 38%] Building C object Lab_05_Lib/CMakeFiles/Lab_05_Lib.dir/LastErrorMessage.c.obj
[ 44%] Building C object Lab_05_Lib/CMakeFiles/Lab_05_Lib.dir/Args.c.obj
[ 50%] Building C object Lab_05_Lib/CMakeFiles/Lab_05_Lib.dir/ArgsPrivate.c.obj
[ 55%] Linking C static library libLab_05_Lib.a
[ 55%] Built target Lab_05_Lib
Scanning dependencies of target Lab_05_Server
[ 61%] Building C object Lab_05_Server/CMakeFiles/Lab_05_Server.dir/main.c.obj
[ 66%] Building C object Lab_05_Server/CMakeFiles/Lab_05_Server.dir/Server.c.obj
C:\Users\vladislav\Projects\SystemProgramming\0x0A\Lab_05\Lab_05_Server\Server.c: In function 'Server':
C:\Users\vladislav\Projects\SystemProgramming\0x0A\Lab_05\Lab_05_Server\Server.c:42:9: warning: implicit declaration of function 'inet_ntop'; did you mean 'inet_ntoa'? [-Wimplicit-function-declaration]
    if (inet_ntop(clientAddressIn->sin_family,
        ^~~~~~
        inet_ntoa
C:\Users\vladislav\Projects\SystemProgramming\0x0A\Lab_05\Lab_05_Server\Server.c:45:34: warning: comparison between pointer and integer
        addressLength) == NULL)
                        ^~
[ 72%] Building C object Lab_05_Server/CMakeFiles/Lab_05_Server.dir/ServerArgs.c.obj
[ 77%] Linking C executable Lab_05_Server.exe
[ 77%] Built target Lab_05_Server
Scanning dependencies of target Lab_05_Client
[ 83%] Building C object Lab_05_Client/CMakeFiles/Lab_05_Client.dir/main.c.obj
[ 88%] Building C object Lab_05_Client/CMakeFiles/Lab_05_Client.dir/Client.c.obj
[ 94%] Building C object Lab_05_Client/CMakeFiles/Lab_05_Client.dir/ClientArgs.c.obj
[100%] Linking C executable Lab_05_Client.exe
[100%] Built target Lab_05_Client
PS C:\Users\vladislav\Projects\SystemProgramming\0x0A\Lab_05\buildcmake>
```

Рисунок 28 – Конец работы mingw32-make

4.4.2. Сборка на сервере с помощью autotools

```
vladislav@MySandbox: ~/Projects/SystemProgramming/0x0A/Lab_05
vladislav@MySandbox:~/Projects/SystemProgramming/0x0A/Lab_05$ uname -a
Linux MySandbox 4.4.0-161-generic #189-Ubuntu SMP Tue Aug 27 08:10:16 UTC 2019 x86_64 x86_64 x86_64 GNU/Linux
vladislav@MySandbox:~/Projects/SystemProgramming/0x0A/Lab_05$ gcc --version
gcc (Ubuntu 5.4.0-6ubuntu1~16.04.12) 5.4.0 20160609
Copyright (C) 2015 Free Software Foundation, Inc.
This is free software; see the source for copying conditions. There is NO
warranty; not even for MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.

vladislav@MySandbox:~/Projects/SystemProgramming/0x0A/Lab_05$ ./configure
checking for gcc... gcc
checking whether the C compiler works... yes
checking for C compiler default output file name... a.out
checking for suffix of executables...
checking whether we are cross compiling... no
checking for suffix of object files... o
checking whether we are using the GNU C compiler... yes
checking whether gcc accepts -g... yes
checking for gcc option to accept ISO C89... none needed
checking whether gcc understands -c and -o together... yes
checking how to run the C preprocessor... gcc -E
checking for grep that handles long lines and -e... /bin/grep
checking for egrep... /bin/grep -E
checking for ANSI C header files... yes
```

Рисунок 29 – Запуск ./configure

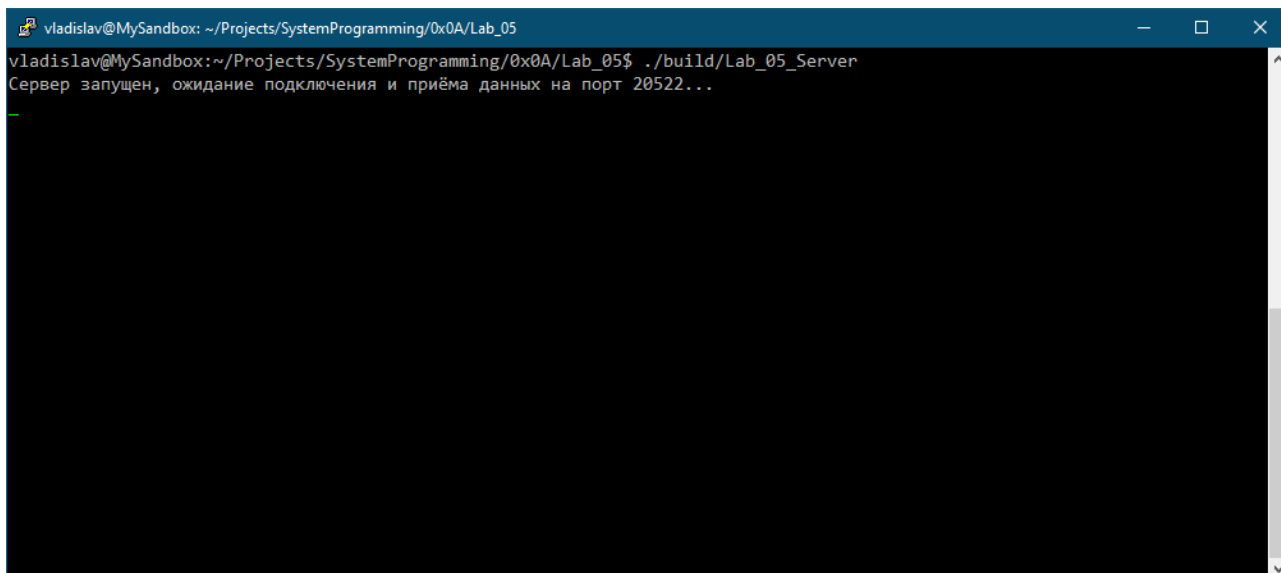
```
vladislav@MySandbox: ~/Projects/SystemProgramming/0x0A/Lab_05
config.status: creating build/Makefile
config.status: creating Makefile
config.status: executing depfiles commands
vladislav@MySandbox:~/Projects/SystemProgramming/0x0A/Lab_05$ make
Making all in build
make[1]: Entering directory '/home/vladislav/Projects/SystemProgramming/0x0A/Lab_05/build'
gcc -DPACKAGE_NAME="Lab_05" -DPACKAGE_TARNAME="lab_05" -DPACKAGE_VERSION="3.0" -DPACKAGE_STRING="Lab_05 3.0" -DPACKAGE_BUGREPORT="misterptits@yandex.ru" -DPACKAGE_URL="" -DSTDC_HEADERS=1 -DHAVE_SYS_TYPES_H=1 -DHAVE_SYS_STAT_H=1 -DHAVE_STDLIB_H=1 -DHAVE_STRING_H=1 -DHAVE_MEMORY_H=1 -DHAVE_STRINGS_H=1 -DHAVE_INTTYPES_H=1 -DHAVE_STDINT_H=1 -DHAVE_UNISTD_H=1 -DHAVE_ARPA_INET_H=1 -DHAVE_FCNTL_H=1 -DHAVE_LIMITS_H=1 -DHAVE_MALLOC_H=1 -DHAVE_NETINET_IN_H=1 -DHAVE_STDEF_H=1 -DHAVE_STDINT_H=1 -DHAVE_STDLIB_H=1 -DHAVE_STRING_H=1 -DHAVE_SYS_SOCKET_H=1 -DHAVE_UNISTD_H=1 -DHAVE_BOOL_H=1 -DHAVE_STDLIB_H=1 -DHAVE_MALLOC_H=1 -DHAVE_STDLIB_H=1 -DHAVE_REALLOC_H=1 -DHAVE_DECL_STRERROR_R=1 -DHAVE_STRERROR_R=1 -DHAVE_SOCKET=1 -DHAVE_STRCHR=1 -DPACKAGE="lab_05" -DVERSION="3.0" -I. -I../Lab_05_MatrixLib -std=gnu99 -g -O2 -MT ../Lab_05_Lib/libLab_05_Lib_a-LastErrorMessage.o -MD -MP -MF ../Lab_05_Lib/.deps/libLab_05_Lib_a-LastErrorMessage.Tpo -c -o ../Lab_05_Lib/libLab_05_Lib_a-LastErrorMessage.o `test -f ../Lab_05_Lib/LastErrorMessage.c` || echo './../Lab_05_Lib/LastErrorMessage.c'
mv -f ../Lab_05_Lib/.deps/libLab_05_Lib_a-LastErrorMessage.Tpo ../Lab_05_Lib/.deps/libLab_05_Lib_a-LastErrorMessage.Po
gcc -DPACKAGE_NAME="Lab_05" -DPACKAGE_TARNAME="lab_05" -DPACKAGE_VERSION="3.0" -DPACKAGE_STRING="Lab_05 3.0" -DPACKAGE_BUGREPORT="misterptits@yandex.ru" -DPACKAGE_URL="" -DSTDC_HEADERS=1 -DHAVE_SYS_TYPES_H=1 -DHAVE_SYS_STAT_H=1 -DHAVE_STDLIB_H=1 -DHAVE_STRING_H=1 -DHAVE_MEMORY_H=1 -DHAVE_STRINGS_H=1 -DHAVE_INTTYPES_H=1 -DHAVE_STDINT_H=1 -DHAVE_UNISTD_H=1 -DHAVE_ARPA_INET_H=1 -DHAVE_FCNTL_H=1 -DHAVE_LIMITS_H=1 -DHAVE_MALLOC_H=1 -DHAVE_NETINET_IN_H=1 -DHAVE_STDEF_H=1 -DHAVE_STDINT_H=1 -DHAVE_STDLIB_H=1 -DHAVE_STRING_H=1 -DHAVE_SYS_SOCKET_H=1 -DHAVE_UNISTD_H=1 -DHAVE_BOOL_H=1 -DHAVE_STDLIB_H=1 -DHAVE_MALLOC_H=1 -DHAVE_STDLIB_H=1 -DHAVE_REALLOC_H=1 -DHAVE_DECL_STRERROR_R=1 -DHAVE_STRERROR_R=1 -DHAVE_SOCKET=1 -DHAVE_STRCHR=1 -DPACKAGE="lab_05" -DVERSION="3.0" -I. -I../Lab_05_MatrixLib -std=gnu99 -g -O2 -MT ../Lab_05_Lib/libLab_05_Lib_a-Re
```

Рисунок 30 – Запуск make

```
vladislav@MySandbox: ~/Projects/SystemProgramming/0x0A/Lab_05
TDINT_H=1 -DHAVE_STDLIB_H=1 -DHAVE_STRING_H=1 -DHAVE_SYS_SOCKET_H=1 -DHAVE_UNISTD_H=1 -DHAVE_BOOL_H=1 -DHAVE_STDLIB_H=1 -DHAVE_MALLOC_H=1 -DHAVE_STDLIB_H=1 -DHAVE_REALLOC_H=1 -DHAVE_DECL_STRERROR_R=1 -DHAVE_STRERROR_R=1 -DHAVE_SOCKET=1 -DHAVE_STRCHR=1 -DPACKAGE="lab_05" -DVERSION="3.0" -I. -I../Lab_05_MatrixLib -I../Lab_05_Lib -std=gnu99 -g -O2 -MT ../Lab_05_Server/Lab_05_Server-Server.o -MD -MP -MF ../Lab_05_Server/.deps/Lab_05_Server-Server.Tpo -c -o ../Lab_05_Server/Lab_05_Server-Server.o `test -f ../Lab_05_Server/Server.c` || echo './../Lab_05_Server/Server.c'
mv -f ../Lab_05_Server/.deps/Lab_05_Server-Server.Tpo ../Lab_05_Server/.deps/Lab_05_Server-Server.Po
gcc -DPACKAGE_NAME="Lab_05" -DPACKAGE_TARNAME="lab_05" -DPACKAGE_VERSION="3.0" -DPACKAGE_STRING="Lab_05 3.0" -DPACKAGE_BUGREPORT="misterptits@yandex.ru" -DPACKAGE_URL="" -DSTDC_HEADERS=1 -DHAVE_SYS_TYPES_H=1 -DHAVE_SYS_STAT_H=1 -DHAVE_STDLIB_H=1 -DHAVE_STRING_H=1 -DHAVE_MEMORY_H=1 -DHAVE_STRINGS_H=1 -DHAVE_INTTYPES_H=1 -DHAVE_STDINT_H=1 -DHAVE_UNISTD_H=1 -DHAVE_ARPA_INET_H=1 -DHAVE_FCNTL_H=1 -DHAVE_LIMITS_H=1 -DHAVE_MALLOC_H=1 -DHAVE_NETINET_IN_H=1 -DHAVE_STDEF_H=1 -DHAVE_STDINT_H=1 -DHAVE_STDLIB_H=1 -DHAVE_STRING_H=1 -DHAVE_SYS_SOCKET_H=1 -DHAVE_UNISTD_H=1 -DHAVE_BOOL_H=1 -DHAVE_STDLIB_H=1 -DHAVE_MALLOC_H=1 -DHAVE_STDLIB_H=1 -DHAVE_REALLOC_H=1 -DHAVE_DECL_STRERROR_R=1 -DHAVE_STRERROR_R=1 -DHAVE_SOCKET=1 -DHAVE_STRCHR=1 -DPACKAGE="lab_05" -DVERSION="3.0" -I. -I../Lab_05_MatrixLib -I../Lab_05_Lib -std=gnu99 -g -O2 -MT ../Lab_05_Server/Lab_05_Server-main.o -MD -MP -MF ../Lab_05_Server/.deps/Lab_05_Server-main.Tpo -c -o ../Lab_05_Server/Lab_05_Server-main.o `test -f ../Lab_05_Server/main.c` || echo './../Lab_05_Server/main.c'
mv -f ../Lab_05_Server/.deps/Lab_05_Server-main.Tpo ../Lab_05_Server/.deps/Lab_05_Server-main.Po
gcc -I../Lab_05_MatrixLib -I../Lab_05_Lib -std=gnu99 -g -O2 -o Lab_05_Server ../Lab_05_Server/Lab_05_Server-ServerArgs.o ../Lab_05_Server/Lab_05_Server-Server.o ../Lab_05_Server/Lab_05_Server-main.o libLab_05_MatrixLib.a libLab_05_Lib.a
make[1]: Leaving directory '/home/vladislav/Projects/SystemProgramming/0x0A/Lab_05/build'
make[1]: Entering directory '/home/vladislav/Projects/SystemProgramming/0x0A/Lab_05'
make[1]: Nothing to be done for 'all-am'.
make[1]: Leaving directory '/home/vladislav/Projects/SystemProgramming/0x0A/Lab_05'
vladislav@MySandbox:~/Projects/SystemProgramming/0x0A/Lab_05$
```

Рисунок 31 – Конец работы make

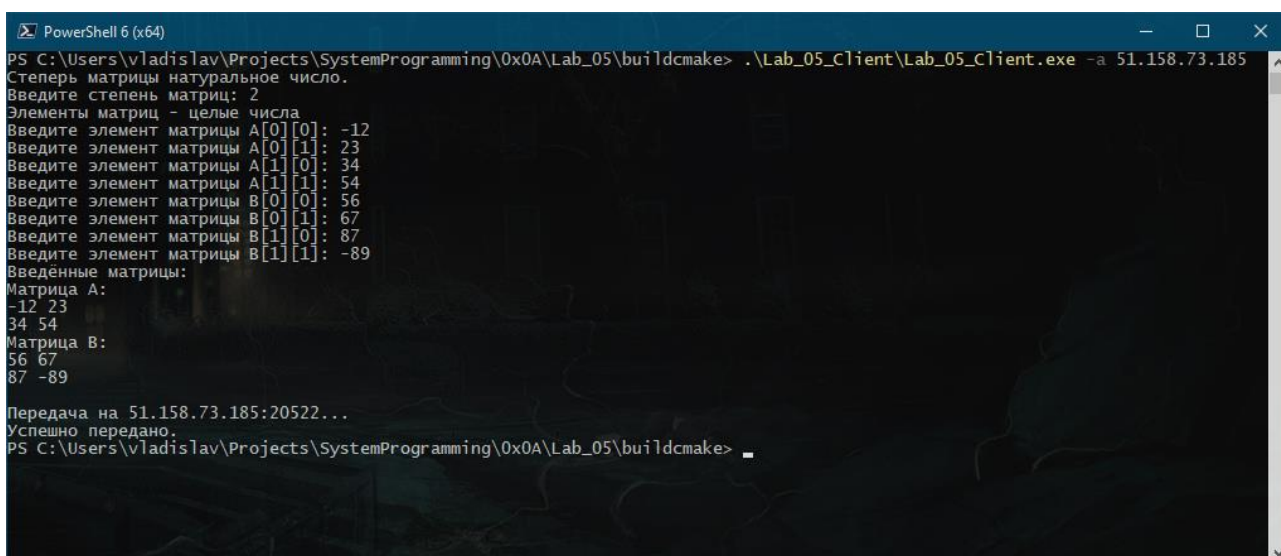
4.4.3. Запуск сервера



```
vladislav@MySandbox: ~/Projects/SystemProgramming/0x0A/Lab_05
vladislav@MySandbox:~/Projects/SystemProgramming/0x0A/Lab_05$ ./build/Lab_05_Server
Сервер запущен, ожидание подключения и приёма данных на порт 20522...
```

Рисунок 32 – Запуск сервера

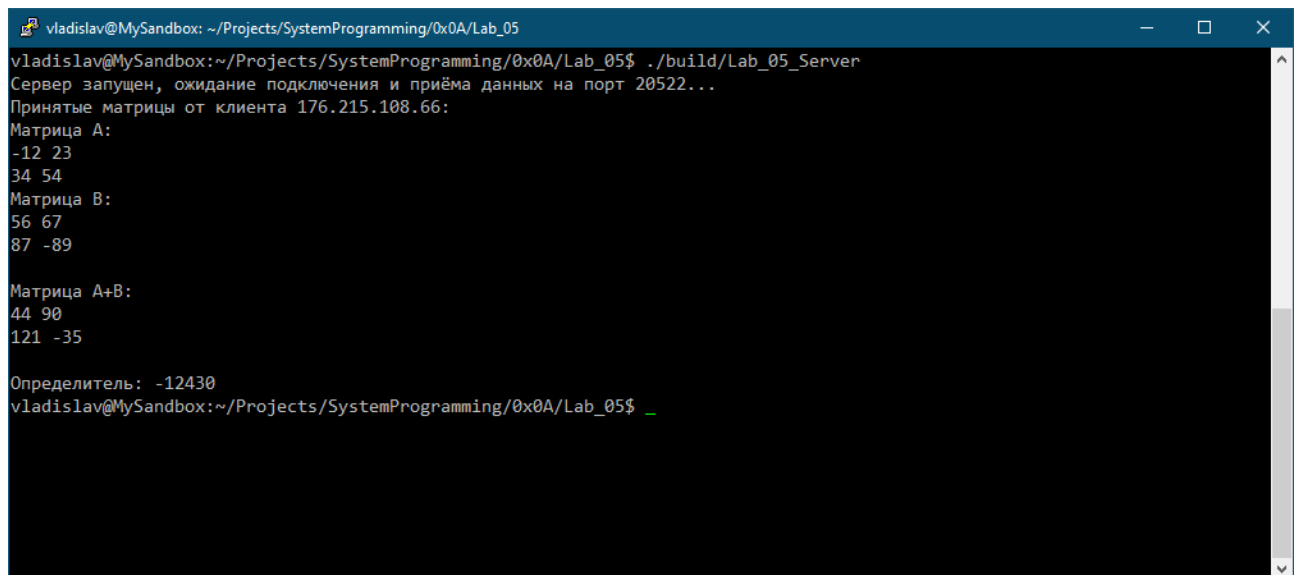
4.4.4. Запуск клиента



```
PS C:\Users\vladislav\Projects\SystemProgramming\0x0A\Lab_05\buildcmake> .\Lab_05_Client\Lab_05_Client.exe -a 51.158.73.185
Степерь матрицы натуральное число.
Введите степень матриц: 2
Элементы матриц - целые числа
Введите элемент матрицы A[0][0]: -12
Введите элемент матрицы A[0][1]: 23
Введите элемент матрицы A[1][0]: 34
Введите элемент матрицы A[1][1]: 54
Введите элемент матрицы B[0][0]: 56
Введите элемент матрицы B[0][1]: 67
Введите элемент матрицы B[1][0]: 87
Введите элемент матрицы B[1][1]: -89
Введённые матрицы:
Матрица A:
-12 23
34 54
Матрица B:
56 67
87 -89
Передача на 51.158.73.185:20522...
Успешно передано.
PS C:\Users\vladislav\Projects\SystemProgramming\0x0A\Lab_05\buildcmake>
```

Рисунок 33 – Запуск клиента

4.4.5. Результат работы сервера

A terminal window with a dark blue title bar and a black background. The text is white. The window title is 'vladislav@MySandbox: ~/Projects/SystemProgramming/0x0A/Lab_05'. The output shows the server starting, waiting for a client, receiving two matrices, calculating their sum, and returning a result.

```
vladislav@MySandbox: ~/Projects/SystemProgramming/0x0A/Lab_05$ ./build/Lab_05_Server
Сервер запущен, ожидание подключения и приёма данных на порт 20522...
Принятые матрицы от клиента 176.215.108.66:
Матрица A:
-12 23
34 54
Матрица B:
56 67
87 -89
Матрица A+B:
44 90
121 -35
Определитель: -12430
vladislav@MySandbox:~/Projects/SystemProgramming/0x0A/Lab_05$ _
```

Рисунок 34 – Результат работы сервера