**EE544 Fall 2014 Sections 1 and 2**

**Computer Networks and Internets**

**Dr. Yutao He**

**Project 1 – Socket Network Programming in Python**

**Due: November 5th, 2014**

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# Abstract

The first project is intended to implement a echo server and client software so as to:

Get acquainted with the socket-based networking programming model

Get acquainted with the Python programming and its associated libraries

# Design Description

In this project we are required to implement two Python programs, one is server called

echoServer.py and the other is called echoClient.py.

The program behaves as follows:

The client can send a message to the server, and the server will echo back any received

message from to the client. In particular, once a return is pressed, the server will have to

echo back the message the client sends to the server.

For example, if you run the Echo server on a machine, and run the client on another, the

following are the messages you should receive at the client:

>Hello, Master! (from the client)

>Echo: Hello, Master! (from the server)

> My name is Android. (from the client)

>Echo: My name is Android. (from the server)Results

In addition to the high-level functions as described above, two programs also need to

satisfy the following requirements:

1. **Support command-line arguments:**

Both echoServer.py and echoClient.py can be run with a command options in the

format:

echoClient.py [options]

For example, % echoClient.py –t TCP/UDP –c –ip IPADD –h –v will be able to start the program with the desired features. The syntax and functions are defined in Table 1.

1. **(2) Additional operation modes as specified in Table 1.**

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| **Options** | **Functions** |
| -h | Display supported options.  For example, % echoServer.py –h will display the following:  % Usage: echoServer.py [options]  OPTIONS:  –c Continuous echo mode.  –h Display the available options  –-ip IPADD Specify the server IP address  –t TCP/UDP Specify the transport layer protocol.  –v Print the software version  Default is to launch the program in default modes. |
| -c | Specify the operation mode.  For example, % echoClient.py –c will start echoClient in the  continuous mode. That is, what a user types on the client machine will be continuously sent to the server and echo back.  Default is the non-continuous mode. That is, the client sends the  message to be echoed by hit the Return key. |
| -v | Print the software version.  For example, %echoClient.py –v will print out the following  % echoClient.py version1.0  Default is not to display the version. |
| --ip IPADD | Specify the server IP address. It is only available for the server.  For example, %echoClient.py –ip 192.168.1.1 will connect the server on the machine with an IP address of 192.168.1.1.  Default is the loop-back address: 127.0.0.1 |
| -t TCP/UDP | Specify the transport layer protocol the server/client uses.  Default is TCP. Note both the server and client need to use the same protocol. |

# Results

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| [root@localhost echo]# **python echoServer.py -h**  OPTIONS:  -c Continuous echo mode.  -h Display the available options  -ip IPADD Specify the server IP Address  -t TCP/UDP Specify the transport layer protocol.  -v Print the software version  [root@localhost echo]# **python echoServer.py -v**  echoServer.py version1.0  [root@localhost echo]# **python echoServer.py -t UDP**  protocolo UDP  UDP Socket bind complete  Socket bind complete  .  .  .  [root@localhost echo]# **python echoServer.py -t TCP**  protocolo TCP  TCP Socket bind complete  Socket bind complete  Socket now listening |
| [root@localhost echo]# python echoClient.py --ip 127.0.0.1 -t TCP  127.0.0.1 version1.0  protocolo TCP  >HELLO MASTER  >ECHO:HELLO MASTER  >WELCOME BACK  >ECHO:WELCOME BACK |
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| **TCP SESSION** |
| [root@localhost echo]# **python echoClient.py --ip 127.0.0.1 -t TCP**  127.0.0.1 version1.0  protocolo TCP  >**HELLO MASTER**  >ECHO:**HELLO MASTER**  >**WELCOME BACK**  >ECHO:WELCOME BACK |
| [root@localhost echo]# **tcpdump -nnvvXSs 1514 -i lo port 4002**  tcpdump: listening on lo, link-type EN10MB (Ethernet), capture size 1514 bytes  15:30:11.106833 IP (tos 0x0, ttl 64, id 46169, offset 0, flags [DF], proto TCP (6), length 60)  127.0.0.1.46096 > 127.0.0.1.4002: Flags [S], cksum 0x7e1e (correct), seq 2228874053, win 32792, options [mss 16396,sackOK,TS val 2122473244 ecr 0,nop,wscale 5], length 0  0x0000: 4500 003c b459 4000 4006 8860 7f00 0001 E..<.Y@.@..`....  0x0010: 7f00 0001 b410 0fa2 84d9 eb45 0000 0000 ...........E....  0x0020: a002 8018 7e1e 0000 0204 400c 0402 080a ....~.....@.....  0x0030: 7e82 5f1c 0000 0000 0103 0305 ~.\_.........  15:30:11.106885 IP (tos 0x0, ttl 64, id 0, offset 0, flags [DF], proto TCP (6), length 60)  127.0.0.1.4002 > 127.0.0.1.46096: Flags [S.], cksum 0xc9c8 (correct), seq 1502706988, ack 2228874054, win 32768, options [mss 16396,sackOK,TS val 2122473244 ecr 2122473244,nop,wscale 5], length 0  0x0000: 4500 003c 0000 4000 4006 3cba 7f00 0001 E..<..@.@.<.....  0x0010: 7f00 0001 0fa2 b410 5991 7d2c 84d9 eb46 ........Y.},...F  0x0020: a012 8000 c9c8 0000 0204 400c 0402 080a ..........@.....  0x0030: 7e82 5f1c 7e82 5f1c 0103 0305 ~.\_.~.\_.....  15:30:11.106904 IP (tos 0x0, ttl 64, id 46170, offset 0, flags [DF], proto TCP (6), length 52)  127.0.0.1.46096 > 127.0.0.1.4002: Flags [.], cksum 0xaeea (correct), seq 2228874054, ack 1502706989, win 1025, options [nop,nop,TS val 2122473244 ecr 2122473244], length 0  0x0000: 4500 0034 b45a 4000 4006 8867 7f00 0001 E..4.Z@.@..g....  0x0010: 7f00 0001 b410 0fa2 84d9 eb46 5991 7d2d ...........FY.}-  0x0020: 8010 0401 aeea 0000 0101 080a 7e82 5f1c ............~.\_.  0x0030: 7e82 5f1c ~.\_.  15:30:17.296666 IP (tos 0x0, ttl 64, id 46171, offset 0, flags [DF], proto TCP (6), length 65)  127.0.0.1.46096 > 127.0.0.1.4002: Flags [P.], cksum 0xfe35 (incorrect -> 0xc30d), seq 2228874054:2228874067, ack 1502706989, win 1025, options [nop,nop,TS val 2122479434 ecr 2122473244], length 13  0x0000: 4500 0041 b45b 4000 4006 8859 7f00 0001 E..A.[@.@..Y....  0x0010: 7f00 0001 b410 0fa2 84d9 eb46 5991 7d2d ...........FY.}-  0x0020: 8018 0401 fe35 0000 0101 080a 7e82 774a .....5......~.wJ  0x0030: 7e82 5f1c 4845 4c4c 4f20 4d41 5354 4552 ~.\_.**HELLO.MASTER**  0x0040: 0a .  15:30:17.296757 IP (tos 0x0, ttl 64, id 8753, offset 0, flags [DF], proto TCP (6), length 52)  127.0.0.1.4002 > 127.0.0.1.46096: Flags [.], cksum 0x7e82 (correct), seq 1502706989, ack 2228874067, win 1024, options [nop,nop,TS val 2122479434 ecr 2122479434], length 0  0x0000: 4500 0034 2231 4000 4006 1a91 7f00 0001 E..4"1@.@.......  0x0010: 7f00 0001 0fa2 b410 5991 7d2d 84d9 eb53 ........Y.}-...S  0x0020: 8010 0400 7e82 0000 0101 080a 7e82 774a ....~.......~.wJ  0x0030: 7e82 774a ~.wJ  15:30:17.296805 IP (tos 0x0, ttl 64, id 8754, offset 0, flags [DF], proto TCP (6), length 65)  127.0.0.1.4002 > 127.0.0.1.46096: Flags [P.], cksum 0xfe35 (incorrect -> 0xaad3), seq 1502706989:1502707002, ack 2228874067, win 1024, options [nop,nop,TS val 2122479434 ecr 2122479434], length 13  0x0000: 4500 0041 2232 4000 4006 1a83 7f00 0001 E..A"2@.@.......  0x0010: 7f00 0001 0fa2 b410 5991 7d2d 84d9 eb53 ........Y.}-...S  0x0020: 8018 0400 fe35 0000 0101 080a 7e82 774a .....5......~.wJ  0x0030: 7e82 774a 4845 4c4c 4f20 4d41 5354 4552 ~.**wJHELLO.MASTER**  0x0040: 0a .  15:30:17.297036 IP (tos 0x0, ttl 64, id 46172, offset 0, flags [DF], proto TCP (6), length 52)  127.0.0.1.46096 > 127.0.0.1.4002: Flags [.], cksum 0x7e74 (correct), seq 2228874067, ack 1502707002, win 1025, options [nop,nop,TS val 2122479434 ecr 2122479434], length 0  0x0000: 4500 0034 b45c 4000 4006 8865 7f00 0001 E..4.\@.@..e....  0x0010: 7f00 0001 b410 0fa2 84d9 eb53 5991 7d3a ...........SY.}:  0x0020: 8010 0401 7e74 0000 0101 080a 7e82 774a ....~t......~.wJ  0x0030: 7e82 774a ~.wJ  15:30:22.455629 IP (tos 0x0, ttl 64, id 46173, offset 0, flags [DF], proto TCP (6), length 65)  127.0.0.1.46096 > 127.0.0.1.4002: Flags [P.], cksum 0xfe35 (incorrect -> 0xa2b5), seq 2228874067:2228874080, ack 1502707002, win 1025, options [nop,nop,TS val 2122484593 ecr 2122479434], length 13  0x0000: 4500 0041 b45d 4000 4006 8857 7f00 0001 E..A.]@.@..W....  0x0010: 7f00 0001 b410 0fa2 84d9 eb53 5991 7d3a ...........SY.}:  0x0020: 8018 0401 fe35 0000 0101 080a 7e82 8b71 .....5......~..q  0x0030: 7e82 774a 5745 4c43 4f4d 4520 4241 434b ~.**wJWELCOME.BACK**  0x0040: 0a .  15:30:22.455729 IP (tos 0x0, ttl 64, id 8755, offset 0, flags [DF], proto TCP (6), length 65)  127.0.0.1.4002 > 127.0.0.1.46096: Flags [P.], cksum 0xfe35 (incorrect -> 0x8e82), seq 1502707002:1502707015, ack 2228874080, win 1024, options [nop,nop,TS val 2122484593 ecr 2122484593], length 13  0x0000: 4500 0041 2233 4000 4006 1a82 7f00 0001 E..A"3@.@.......  0x0010: 7f00 0001 0fa2 b410 5991 7d3a 84d9 eb60 ........Y.}:...`  0x0020: 8018 0400 fe35 0000 0101 080a 7e82 8b71 .....5......~..q  0x0030: 7e82 8b71 5745 4c43 4f4d 4520 4241 434b ~..**qWELCOME.BACK**  0x0040: 0a |

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| **TCP SESSION CONTINOUOS** |
| [root@localhost echo]# python echoClient.py --ip 127.0.0.1 -t TCP -c  127.0.0.1 version1.0  protocolo TCP  continouos  **LLIIFFEE** |
| [root@localhost echo]# tcpdump -nnvvXSs 1514 -i lo port 4002  tcpdump: listening on lo, link-type EN10MB (Ethernet), capture size 1514 bytes  15:58:55.789168 IP (tos 0x0, ttl 64, id 57001, offset 0, flags [DF], proto TCP (6), length 60)  127.0.0.1.46097 > 127.0.0.1.4002: Flags [S], cksum 0x7cb3 (correct), seq 2983554703, win 32792, options [mss 16396,sackOK,TS val 2124197926 ecr 0,nop,wscale 5], length 0  0x0000: 4500 003c dea9 4000 4006 5e10 7f00 0001 E..<..@.@.^.....  0x0010: 7f00 0001 b411 0fa2 b1d5 6e8f 0000 0000 ..........n.....  0x0020: a002 8018 7cb3 0000 0204 400c 0402 080a ....|.....@.....  0x0030: 7e9c b026 0000 0000 0103 0305 ~..&........  15:58:55.790115 IP (tos 0x0, ttl 64, id 0, offset 0, flags [DF], proto TCP (6), length 60)  127.0.0.1.4002 > 127.0.0.1.46097: Flags [S.], cksum 0xb1d2 (correct), seq 1496204021, ack 2983554704, win 32768, options [mss 16396,sackOK,TS val 2124197927 ecr 2124197926,nop,wscale 5], length 0  0x0000: 4500 003c 0000 4000 4006 3cba 7f00 0001 E..<..@.@.<.....  0x0010: 7f00 0001 0fa2 b411 592e 42f5 b1d5 6e90 ........Y.B...n.  0x0020: a012 8000 b1d2 0000 0204 400c 0402 080a ..........@.....  0x0030: 7e9c b027 7e9c b026 0103 0305 ~..'~..&....  15:58:55.790903 IP (tos 0x0, ttl 64, id 57002, offset 0, flags [DF], proto TCP (6), length 52)  127.0.0.1.46097 > 127.0.0.1.4002: Flags [.], cksum 0x96f2 (correct), seq 2983554704, ack 1496204022, win 1025, options [nop,nop,TS val 2124197928 ecr 2124197927], length 0  0x0000: 4500 0034 deaa 4000 4006 5e17 7f00 0001 E..4..@.@.^.....  0x0010: 7f00 0001 b411 0fa2 b1d5 6e90 592e 42f6 ..........n.Y.B.  0x0020: 8010 0401 96f2 0000 0101 080a 7e9c b028 ............~..(  0x0030: 7e9c b027 ~..'  15:59:30.198712 IP (tos 0x0, ttl 64, id 57003, offset 0, flags [DF], proto TCP (6), length 53)  127.0.0.1.46097 > 127.0.0.1.4002: Flags [P.], cksum 0xfe29 (incorrect -> 0xc480), seq 2983554704:2983554705, ack 1496204022, win 1025, options [nop,nop,TS val 2124232336 ecr 2124197927], length 1  0x0000: 4500 0035 deab 4000 4006 5e15 7f00 0001 E..5..@.@.^.....  0x0010: 7f00 0001 b411 0fa2 b1d5 6e90 592e 42f6 ..........n.Y.B.  0x0020: 8018 0401 fe29 0000 0101 080a 7e9d 3690 .....)......~.6.  0x0030: 7e9c b027 4c ~..'**L**  15:59:30.199072 IP (tos 0x0, ttl 64, id 62174, offset 0, flags [DF], proto TCP (6), length 52)  127.0.0.1.4002 > 127.0.0.1.46097: Flags [.], cksum 0x8a20 (correct), seq 1496204022, ack 2983554705, win 1024, options [nop,nop,TS val 2124232336 ecr 2124232336], length 0  0x0000: 4500 0034 f2de 4000 4006 49e3 7f00 0001 E..4..@.@.I.....  0x0010: 7f00 0001 0fa2 b411 592e 42f6 b1d5 6e91 ........Y.B...n.  0x0020: 8010 0400 8a20 0000 0101 080a 7e9d 3690 ............~.6.  0x0030: 7e9d 3690 ~.6.  15:59:30.199419 IP (tos 0x0, ttl 64, id 62175, offset 0, flags [DF], proto TCP (6), length 53)  127.0.0.1.4002 > 127.0.0.1.46097: Flags [P.], cksum 0xfe29 (incorrect -> 0x3e17), seq 1496204022:1496204023, ack 2983554705, win 1024, options [nop,nop,TS val 2124232336 ecr 2124232336], length 1  0x0000: 4500 0035 f2df 4000 4006 49e1 7f00 0001 E..5..@.@.I.....  0x0010: 7f00 0001 0fa2 b411 592e 42f6 b1d5 6e91 ........Y.B...n.  0x0020: 8018 0400 fe29 0000 0101 080a 7e9d 3690 .....)......~.6.  0x0030: 7e9d 3690 4c ~.6.**L**  15:59:30.199427 IP (tos 0x0, ttl 64, id 57004, offset 0, flags [DF], proto TCP (6), length 52)  127.0.0.1.46097 > 127.0.0.1.4002: Flags [.], cksum 0x8a1e (correct), seq 2983554705, ack 1496204023, win 1025, options [nop,nop,TS val 2124232336 ecr 2124232336], length 0  0x0000: 4500 0034 deac 4000 4006 5e15 7f00 0001 E..4..@.@.^.....  0x0010: 7f00 0001 b411 0fa2 b1d5 6e91 592e 42f7 ..........n.Y.B.  0x0020: 8010 0401 8a1e 0000 0101 080a 7e9d 3690 ............~.6.  0x0030: 7e9d 3690 ~.6.  15:59:34.838104 IP (tos 0x0, ttl 64, id 57005, offset 0, flags [DF], proto TCP (6), length 53)  127.0.0.1.46097 > 127.0.0.1.4002: Flags [P.], cksum 0xfe29 (incorrect -> 0x2ef6), seq 2983554705:2983554706, ack 1496204023, win 1025, options [nop,nop,TS val 2124236975 ecr 2124232336], length 1  0x0000: 4500 0035 dead 4000 4006 5e13 7f00 0001 E..5..@.@.^.....  0x0010: 7f00 0001 b411 0fa2 b1d5 6e91 592e 42f7 ..........n.Y.B.  0x0020: 8018 0401 fe29 0000 0101 080a 7e9d 48af .....)......~.H.  0x0030: 7e9d 3690 49 ~.6.**I**  15:59:34.838277 IP (tos 0x0, ttl 64, id 62176, offset 0, flags [DF], proto TCP (6), length 53)  127.0.0.1.4002 > 127.0.0.1.46097: Flags [P.], cksum 0xfe29 (incorrect -> 0x1cd7), seq 1496204023:1496204024, ack 2983554706, win 1024, options [nop,nop,TS val 2124236975 ecr 2124236975], length 1  0x0000: 4500 0035 f2e0 4000 4006 49e0 7f00 0001 E..5..@.@.I.....  0x0010: 7f00 0001 0fa2 b411 592e 42f7 b1d5 6e92 ........Y.B...n.  0x0020: 8018 0400 fe29 0000 0101 080a 7e9d 48af .....)......~.H.  0x0030: 7e9d 48af 49 ~.H.**I**  15:59:34.838290 IP (tos 0x0, ttl 64, id 57006, offset 0, flags [DF], proto TCP (6), length 52)  127.0.0.1.46097 > 127.0.0.1.4002: Flags [.], cksum 0x65de (correct), seq 2983554706, ack 1496204024, win 1025, options [nop,nop,TS val 2124236975 ecr 2124236975], length 0  0x0000: 4500 0034 deae 4000 4006 5e13 7f00 0001 E..4..@.@.^.....  0x0010: 7f00 0001 b411 0fa2 b1d5 6e92 592e 42f8 ..........n.Y.B.  0x0020: 8010 0401 65de 0000 0101 080a 7e9d 48af ....e.......~.H.  0x0030: 7e9d 48af ~.H.  15:59:35.677658 IP (tos 0x0, ttl 64, id 57007, offset 0, flags [DF], proto TCP (6), length 53)  127.0.0.1.46097 > 127.0.0.1.4002: Flags [P.], cksum 0xfe29 (incorrect -> 0x1c8d), seq 2983554706:2983554707, ack 1496204024, win 1025, options [nop,nop,TS val 2124237815 ecr 2124236975], length 1  0x0000: 4500 0035 deaf 4000 4006 5e11 7f00 0001 E..5..@.@.^.....  0x0010: 7f00 0001 b411 0fa2 b1d5 6e92 592e 42f8 ..........n.Y.B.  0x0020: 8018 0401 fe29 0000 0101 080a 7e9d 4bf7 .....)......~.K.  0x0030: 7e9d 48af 46 ~.H.**F**  15:59:35.677823 IP (tos 0x0, ttl 64, id 62177, offset 0, flags [DF], proto TCP (6), length 53)  127.0.0.1.4002 > 127.0.0.1.46097: Flags [P.], cksum 0xfe29 (incorrect -> 0x1945), seq 1496204024:1496204025, ack 2983554707, win 1024, options [nop,nop,TS val 2124237815 ecr 2124237815], length 1  0x0000: 4500 0035 f2e1 4000 4006 49df 7f00 0001 E..5..@.@.I.....  0x0010: 7f00 0001 0fa2 b411 592e 42f8 b1d5 6e93 ........Y.B...n.  0x0020: 8018 0400 fe29 0000 0101 080a 7e9d 4bf7 .....)......~.K.  0x0030: 7e9d 4bf7 46 ~.K.**F**  15:59:35.677835 IP (tos 0x0, ttl 64, id 57008, offset 0, flags [DF], proto TCP (6), length 52)  127.0.0.1.46097 > 127.0.0.1.4002: Flags [.], cksum 0x5f4c (correct), seq 2983554707, ack 1496204025, win 1025, options [nop,nop,TS val 2124237815 ecr 2124237815], length 0  0x0000: 4500 0034 deb0 4000 4006 5e11 7f00 0001 E..4..@.@.^.....  0x0010: 7f00 0001 b411 0fa2 b1d5 6e93 592e 42f9 ..........n.Y.B.  0x0020: 8010 0401 5f4c 0000 0101 080a 7e9d 4bf7 ....\_L......~.K.  0x0030: 7e9d 4bf7 ~.K.  15:59:37.390787 IP (tos 0x0, ttl 64, id 57009, offset 0, flags [DF], proto TCP (6), length 53)  127.0.0.1.46097 > 127.0.0.1.4002: Flags [P.], cksum 0xfe29 (incorrect -> 0x1392), seq 2983554707:2983554708, ack 1496204025, win 1025, options [nop,nop,TS val 2124239528 ecr 2124237815], length 1  0x0000: 4500 0035 deb1 4000 4006 5e0f 7f00 0001 E..5..@.@.^.....  0x0010: 7f00 0001 b411 0fa2 b1d5 6e93 592e 42f9 ..........n.Y.B.  0x0020: 8018 0401 fe29 0000 0101 080a 7e9d 52a8 .....)......~.R.  0x0030: 7e9d 4bf7 45 ~.K.**E**  15:59:37.390959 IP (tos 0x0, ttl 64, id 62178, offset 0, flags [DF], proto TCP (6), length 53)  127.0.0.1.4002 > 127.0.0.1.46097: Flags [P.], cksum 0xfe29 (incorrect -> 0x0ce1), seq 1496204025:1496204026, ack 2983554708, win 1024, options [nop,nop,TS val 2124239528 ecr 2124239528], length 1  0x0000: 4500 0035 f2e2 4000 4006 49de 7f00 0001 E..5..@.@.I.....  0x0010: 7f00 0001 0fa2 b411 592e 42f9 b1d5 6e94 ........Y.B...n.  0x0020: 8018 0400 fe29 0000 0101 080a 7e9d 52a8 .....)......~.R.  0x0030: 7e9d 52a8 45 ~.R.**E**  15:59:37.390971 IP (tos 0x0, ttl 64, id 57010, offset 0, flags [DF], proto TCP (6), length 52)  127.0.0.1.46097 > 127.0.0.1.4002: Flags [.], cksum 0x51e8 (correct), seq 2983554708, ack 1496204026, win 1025, options [nop,nop,TS val 2124239528 ecr 2124239528], length 0  0x0000: 4500 0034 deb2 4000 4006 5e0f 7f00 0001 E..4..@.@.^.....  0x0010: 7f00 0001 b411 0fa2 b1d5 6e94 592e 42fa ..........n.Y.B.  0x0020: 8010 0401 51e8 0000 0101 080a 7e9d 52a8 ....Q.......~.R.  0x0030: 7e9d 52a8 ~.R.  15:59:38.909859 IP (tos 0x0, ttl 64, id 57011, offset 0, flags [DF], proto TCP (6), length 53)  127.0.0.1.46097 > 127.0.0.1.4002: Flags [P.], cksum 0xfe29 (incorrect -> 0x41f0), seq 2983554708:2983554709, ack 1496204026, win 1025, options [nop,nop,TS val 2124241047 ecr 2124239528], length 1  0x0000: 4500 0035 deb3 4000 4006 5e0d 7f00 0001 E..5..@.@.^.....  0x0010: 7f00 0001 b411 0fa2 b1d5 6e94 592e 42fa ..........n.Y.B.  0x0020: 8018 0401 fe29 0000 0101 080a 7e9d 5897 .....)......~.X.  0x0030: 7e9d 52a8 0a ~.R..  15:59:38.910013 IP (tos 0x0, ttl 64, id 62179, offset 0, flags [DF], proto TCP (6), length 53)  127.0.0.1.4002 > 127.0.0.1.46097: Flags [P.], cksum 0xfe29 (incorrect -> 0x3c01), seq 1496204026:1496204027, ack 2983554709, win 1024, options [nop,nop,TS val 2124241047 ecr 2124241047], length 1  0x0000: 4500 0035 f2e3 4000 4006 49dd 7f00 0001 E..5..@.@.I.....  0x0010: 7f00 0001 0fa2 b411 592e 42fa b1d5 6e95 ........Y.B...n.  0x0020: 8018 0400 fe29 0000 0101 080a 7e9d 5897 .....)......~.X.  0x0030: 7e9d 5897 0a ~.X..  15:59:38.910025 IP (tos 0x0, ttl 64, id 57012, offset 0, flags [DF], proto TCP (6), length 52)  127.0.0.1.46097 > 127.0.0.1.4002: Flags [.], cksum 0x4608 (correct), seq 2983554709, ack 1496204027, win 1025, options [nop,nop,TS val 2124241047 ecr 2124241047], length 0  0x0000: 4500 0034 deb4 4000 4006 5e0d 7f00 0001 E..4..@.@.^.....  0x0010: 7f00 0001 b411 0fa2 b1d5 6e95 592e 42fb ..........n.Y.B.  0x0020: 8010 0401 4608 0000 0101 080a 7e9d 5897 ....F.......~.X.  0x0030: 7e9d 5897 ~.X. |

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| **UDP SESSION** |
| [root@localhost echo]# **python echoClient.py --ip 127.0.0.1 -t UDP**  127.0.0.1 version1.0  protocolo UDP  >**HELLO MASTER-UDP**  >ECHO:**HELLO MASTER-UDP**  >**WELCOME BACK MASTER-UDP**  >ECHO:**WELCOME BACK MASTER-UDP** |
| [root@localhost echo]# tcpdump -nnvvXSs 1514 -i lo port 4002  tcpdump: listening on lo, link-type EN10MB (Ethernet), capture size 1514 bytes  15:36:44.622770 IP (tos 0x0, ttl 64, id 0, offset 0, flags [DF], proto UDP (17), length 45)  127.0.0.1.53914 > 127.0.0.1.4002: [bad udp cksum 10dc!] UDP, length 17  0x0000: 4500 002d 0000 4000 4011 3cbe 7f00 0001 E..-..@.@.<.....  0x0010: 7f00 0001 d29a 0fa2 0019 fe2c 4845 4c4c ...........,**HELL**  0x0020: 4f20 4d41 5354 4552 2d55 4450 0a **O.MASTER-UDP**.  15:36:44.623666 IP (tos 0x0, ttl 64, id 0, offset 0, flags [DF], proto UDP (17), length 45)  127.0.0.1.4002 > 127.0.0.1.53914: [bad udp cksum 10dc!] UDP, length 17  0x0000: 4500 002d 0000 4000 4011 3cbe 7f00 0001 E..-..@.@.<.....  0x0010: 7f00 0001 0fa2 d29a 0019 fe2c 4845 4c4c ...........,**HELL**  0x0020: 4f20 4d41 5354 4552 2d55 4450 0a **O.MASTER-UDP.**  15:36:59.710676 IP (tos 0x0, ttl 64, id 0, offset 0, flags [DF], proto UDP (17), length 52)  127.0.0.1.53914 > 127.0.0.1.4002: [bad udp cksum 56b6!] UDP, length 24  0x0000: 4500 0034 0000 4000 4011 3cb7 7f00 0001 E..4..@.@.<.....  0x0010: 7f00 0001 d29a 0fa2 0020 fe33 5745 4c43 ...........**3WELC**  0x0020: 4f4d 4520 4241 434b 204d 4153 5445 522d **OME.BACK.MASTER**-  0x0030: 5544 500a **UDP.**  15:36:59.710792 IP (tos 0x0, ttl 64, id 0, offset 0, flags [DF], proto UDP (17), length 52)  127.0.0.1.4002 > 127.0.0.1.53914: [bad udp cksum 56b6!] UDP, length 24  0x0000: 4500 0034 0000 4000 4011 3cb7 7f00 0001 E..4..@.@.<.....  0x0010: 7f00 0001 0fa2 d29a 0020 fe33 5745 4c43 ...........**3WELC**  0x0020: 4f4d 4520 4241 434b 204d 4153 5445 522d **OME.BACK.MASTER-**  0x0030: 5544 500a **UDP.**  15:37:12.213805 IP (tos 0x0, ttl 64, id 0, offset 0, flags [DF], proto UDP (17), length 29)  127.0.0.1.53914 > 127.0.0.1.4002: [bad udp cksum 8017!] UDP, length 1  0x0000: 4500 001d 0000 4000 4011 3cce 7f00 0001 E.....@.@.<.....  0x0010: 7f00 0001 d29a 0fa2 0009 fe1c 0a .............  15:37:12.214002 IP (tos 0x0, ttl 64, id 0, offset 0, flags [DF], proto UDP (17), length 29)  127.0.0.1.4002 > 127.0.0.1.53914: [bad udp cksum 8017!] UDP, length 1  0x0000: 4500 001d 0000 4000 4011 3cce 7f00 0001 E.....@.@.<.....  0x0010: 7f00 0001 0fa2 d29a 0009 fe1c 0a ............. |

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| **UDP SESSION CONTINOUOS** |
| [root@localhost echo]# python echoClient.py --ip 127.0.0.1 -t UDP -c  127.0.0.1 version1.0  protocolo UDP  continouos  **AABBCC!!""** |
| [root@localhost echo]# tcpdump -nnvvXSs 1514 -i lo port 4002  tcpdump: listening on lo, link-type EN10MB (Ethernet), capture size 1514 bytes  15:49:55.387772 IP (tos 0x0, ttl 64, id 0, offset 0, flags [DF], proto UDP (17), length 29)  127.0.0.1.34568 > 127.0.0.1.4002: [bad udp cksum 122c!] UDP, length 1  0x0000: 4500 001d 0000 4000 4011 3cce 7f00 0001 E.....@.@.<.....  0x0010: 7f00 0001 8708 0fa2 0009 fe1c 41 ............**A**  15:49:55.388459 IP (tos 0x0, ttl 64, id 0, offset 0, flags [DF], proto UDP (17), length 29)  127.0.0.1.4002 > 127.0.0.1.34568: [bad udp cksum 122c!] UDP, length 1  0x0000: 4500 001d 0000 4000 4011 3cce 7f00 0001 E.....@.@.<.....  0x0010: 7f00 0001 0fa2 8708 0009 fe1c 41 ............**A**  15:49:57.419949 IP (tos 0x0, ttl 64, id 0, offset 0, flags [DF], proto UDP (17), length 29)  127.0.0.1.34568 > 127.0.0.1.4002: [bad udp cksum 122b!] UDP, length 1  0x0000: 4500 001d 0000 4000 4011 3cce 7f00 0001 E.....@.@.<.....  0x0010: 7f00 0001 8708 0fa2 0009 fe1c 42 ............**B**  15:49:57.420093 IP (tos 0x0, ttl 64, id 0, offset 0, flags [DF], proto UDP (17), length 29)  127.0.0.1.4002 > 127.0.0.1.34568: [bad udp cksum 122b!] UDP, length 1  0x0000: 4500 001d 0000 4000 4011 3cce 7f00 0001 E.....@.@.<.....  0x0010: 7f00 0001 0fa2 8708 0009 fe1c 42 ............**B**  15:49:58.859119 IP (tos 0x0, ttl 64, id 0, offset 0, flags [DF], proto UDP (17), length 29)  127.0.0.1.34568 > 127.0.0.1.4002: [bad udp cksum 122a!] UDP, length 1  0x0000: 4500 001d 0000 4000 4011 3cce 7f00 0001 E.....@.@.<.....  0x0010: 7f00 0001 8708 0fa2 0009 fe1c 43 ...........**.C**  15:49:58.859265 IP (tos 0x0, ttl 64, id 0, offset 0, flags [DF], proto UDP (17), length 29)  127.0.0.1.4002 > 127.0.0.1.34568: [bad udp cksum 122a!] UDP, length 1  0x0000: 4500 001d 0000 4000 4011 3cce 7f00 0001 E.....@.@.<.....  0x0010: 7f00 0001 0fa2 8708 0009 fe1c 43 ............**C**  15:50:02.579642 IP (tos 0x0, ttl 64, id 0, offset 0, flags [DF], proto UDP (17), length 29)  127.0.0.1.34568 > 127.0.0.1.4002: [bad udp cksum 124c!] UDP, length 1  0x0000: 4500 001d 0000 4000 4011 3cce 7f00 0001 E.....@.@.<.....  0x0010: 7f00 0001 8708 0fa2 0009 fe1c 21 ............**!**  15:50:02.579791 IP (tos 0x0, ttl 64, id 0, offset 0, flags [DF], proto UDP (17), length 29)  127.0.0.1.4002 > 127.0.0.1.34568: [bad udp cksum 124c!] UDP, length 1  0x0000: 4500 001d 0000 4000 4011 3cce 7f00 0001 E.....@.@.<.....  0x0010: 7f00 0001 0fa2 8708 0009 fe1c 21 ............**!**  15:50:04.259904 IP (tos 0x0, ttl 64, id 0, offset 0, flags [DF], proto UDP (17), length 29)  127.0.0.1.34568 > 127.0.0.1.4002: [bad udp cksum 124b!] UDP, length 1  0x0000: 4500 001d 0000 4000 4011 3cce 7f00 0001 E.....@.@.<.....  0x0010: 7f00 0001 8708 0fa2 0009 fe1c 22 ............**"**  15:50:04.260053 IP (tos 0x0, ttl 64, id 0, offset 0, flags [DF], proto UDP (17), length 29)  127.0.0.1.4002 > 127.0.0.1.34568: [bad udp cksum 124b!] UDP, length 1  0x0000: 4500 001d 0000 4000 4011 3cce 7f00 0001 E.....@.@.<.....  0x0010: 7f00 0001 0fa2 8708 0009 fe1c 22 ............**"** |

# Design Review

In this project we have tested different Python programming features and find some limitations.

* When passing options to python if we use a option with one character only, it should be used a “-“character. When doing a option with more than one character, we should use “—“. This was found on the “ip” address option.
* In the case of continuous mode, there was not a “Getch” function available. In order to overcome this limitation, we used a function “myGetch” that allowed to process one character at a time. This function worked on Linux.
* On the TCP server, we implemented threads in order to allow simultaneous connections from different clients. This wasn’t implemented on UDP server.
* On the non-continuous TCP and UDP client. We added a escape command “quit” so that we can close the socket on the client side.