

תקשורת ומחשוב – תשפ"א - סמס'א' - מטלה שלישית

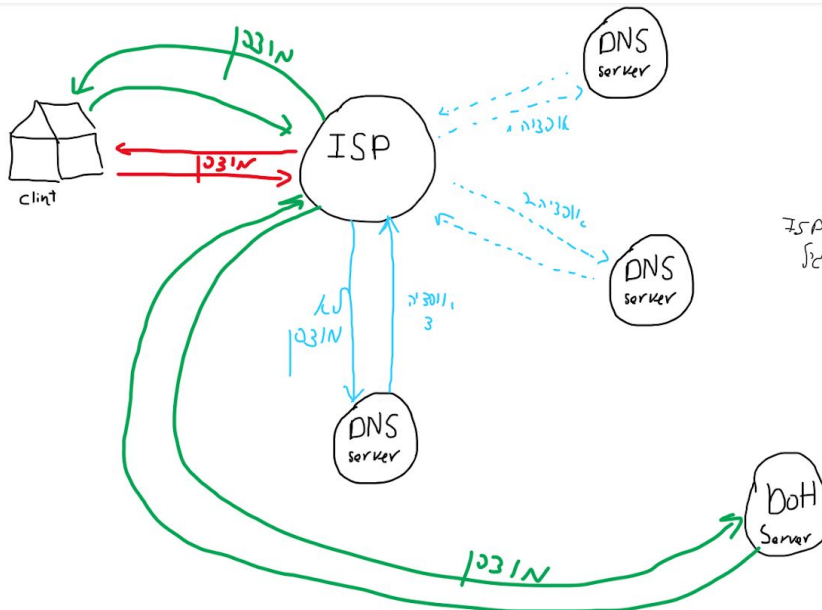
מגישים:

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DoH - א' - חלק

1. במקום שבקשת הכתובת של ה-DNS תהיה חשופה לכל, DoH מצפין את הבקשה לאותה כתובת, כך שלא תהיה גלויה לאנשים זרים.
2. (1) - השימוש בשירות DoH דורש שימוש ביותר משאבים, מאשר השימוש בשירות ה-DNS הרגיל. המשאבים המורחבים שבהם משתמש השירות הם זמן, והכוח חישוב שהולך להצפנת המידע.
(2) - השימוש בשירות DoH דורש שימוש ב-DoH Servers כיוון שאין כמות כל כך גדולה של שרתי DoH לא כמו שרתי DNS רגילים אז יכולים להיווצר עומסים ודיליים ארוכים בגלל מרחק וזמינות של אותם שרתים.
3. הצעת פתרון לבעיה מספר 2:
אפשר להקל על עומס השרתים של ה-DoH בכך שנתאים יותר שרתי DNS קיימים לעבודה עם DoH. אפשרות נוספת היא לא להצפין את המידע עד הסוף זאת אומרת, לאפשר לשרתי ה-ISP לקרוא את המידע המוצפן לשלוח לשרת DNS רגיל ולהחזיר את המידע חזרה מוצפן ללקוח.



הממש plugin ברמת DoH הגדרות המחשב	ברמת DoH proxy שרת מקומי	ברמת DoH proxy שרת ברשת	ברמת DoH האפליקציות	
כל מחשב ברשת בו נרצה להשתמש בDoH - נצטרך להתקין עליו plugin בנפרד. בנוסף, כל הבקשות של DNS במחשב יהיו מוצפנות, מה שיגרום לשימוש מיותר במשאבים.	במקרה בו השרת יותקף לדוגמה ב- DDOS אז המשתמשים לא יוכלו לקבל יותר גישה לשירות DNS, כי השרת המקומי לא יוכל לעמוד בעומס (לעומת שרתי ה- DNS שנמצאו עמידים לתקיפות אלו).	כל המידע עובר לצד ג', ולכן השירות יהיה איטי יותר. מכיוון שהעבודה נעשית מול שרת סרבר פרוקסי יחיד ישנה אפשרות שהשרת יתמלא או יפרץ ולא יאפשר המשך פעולה עם המשתמשים, מה שלא יקרה אם השירות DNS יתבצע על ידי מספר רב של שרתי DNS.	כל גישה חיצונית לאפליקציה תהיה גלויה ל-sniffing.	חסרונות
נוכל לבחור איזה מחשבים נרצה להצפין ואיזה לא. בנוסף, כל השימוש ממחשב עליו מותקן plugin יהיה מוצפן.	החיבור מהלקוח לשרת המקומי הינו מהיר ואמין, בשונה מהסתמכות על שרת פרוקסי ברשת שיכול להיות יותר איטי, ולו רק בגלל המרחק מהלקוח. (RTT נמוך)	כל הפעולות במחשב יוכלו להשתמש בשירות הDoH דרך הפרוקסי, מה שיבטיח חיבור מוצפן לכל הפעולות.	נוכל לבחור מתי להשתמש בשירות ומתי לא. כאשר נרצה להיות מוצפנים נשתמש באותה אפליקציה, אבל בשימוש היום יומי לא נרצה להצפין ע"מ לא לבזבז משאבים מיותרים.	יתרונות

לדעתנו היתרונות של עבודה מהאפליקציה היא הטובה ביותר, היא חוסכת משאבים בכך שלא שולחת לשרתי DoH את כל השאילתות אלא רק את אלו אנו מעוניינים להצפין.

5. היתרון שיש לDoH הוא היכולת לשלוח את ההודעות דרך הפרוטוקול TCP שיכול לוודא שלא איבדנו פקטות בדרך, ואם איבדנו יהיה אפשר להשלים אותם נקודתית (אם עובדים עם pipelining אפשר אפילו לזרז את התהליך הזה עוד יותר).
כל זה בניגוד לעבודה עם DNS שמשמש ברובו בפרוטוקול UDP שלא מאפשר אמינות כמו שה-TCP מביא לנו, אמנם אפשר לבדוק איתו אם המשאבים הגיעו אבל לא יהיה ניתן לדעת אילו ויהיה צורך לשלוח אותם מחדש.

חלק ב' - Congestion Control

https://github.com/hodefiDavid/tcp_cc.git

זמני הגעה ממוצעים (בשניות):

	Cubic	Reno
0%	1.010967	1.010695
10%	1.174116	3.026673
15%	3.786756	1.290456
20%	20.906606	21.15518
25%	11.602118	4.796536
30%	15.532844	73.30371
ממוצע	9.0022345	17.43054

ללא אחוזי איבוד:

```
Activities Terminal Dec 20 19:03 david@david-vm: ~/CLionProjects/tcp_cc
```

```
david@david-vm:~/CLionProjects/tcp_cc$ make
gcc -Wall -o mains measure.c
gcc -Wall -o mainc sender.c
david@david-vm:~/CLionProjects/tcp_cc$ ./mains
new socket opened
Bind() success
Waiting for incoming TCP-connections...
A new client connection accepted
Received 1048576 bytes
Received 1mb completely, file number 1
Time to receive the file from the client was 1.011132 second
Listing...
A new client connection accepted
Received 1048576 bytes
Received 1mb completely, file number 2
Time to receive the file from the client was 1.009569 second
Listing...
A new client connection accepted
Received 1048576 bytes
Received 1mb completely, file number 3
Time to receive the file from the client was 1.010544 second
Listing...
A new client connection accepted
Received 1048576 bytes
Received 1mb completely, file number 4
Time to receive the file from the client was 1.013474 second
Listing...
A new client connection accepted
Received 1048576 bytes
Received 1mb completely, file number 5
Time to receive the file from the client was 1.010117 second
Listing...
Average time to get 5 files in TPC CC cubic is: 1.010967
A new client connection accepted
Received 1048576 bytes
Received 1mb completely, file number 1
Time to receive the file from the client was 1.010117 second
Listing...
```

```
david@david-vm:~/CLionProjects/tcp_cc$ ./mainc
New socket opened
Current: cubic
connect_flag = 0
File Size: 1048576 bytes
From Server : OK
The client send 1048576 bytes, file number 1
New socket opened
Current: cubic
connect_flag = 0
File Size: 1048576 bytes
From Server : OK
The client send 1048576 bytes, file number 2
New socket opened
Current: cubic
connect_flag = 0
File Size: 1048576 bytes
From Server : OK
The client send 1048576 bytes, file number 3
New socket opened
Current: cubic
connect_flag = 0
File Size: 1048576 bytes
From Server : OK
The client send 1048576 bytes, file number 4
New socket opened
Current: cubic
connect_flag = 0
File Size: 1048576 bytes
From Server : OK
The client send 1048576 bytes, file number 5
New socket opened
Current: reno
connect_flag = 0
File Size: 1048576 bytes
From Server : OK
The client send 1048576 bytes, file number 6
New socket opened
Current: reno
connect_flag = 0
File Size: 1048576 bytes
From Server : OK
The client send 1048576 bytes, file number 7
New socket opened
Current: reno
connect_flag = 0
File Size: 1048576 bytes
From Server : OK
The client send 1048576 bytes, file number 8
New socket opened
Current: reno
connect_flag = 0
File Size: 1048576 bytes
From Server : OK
The client send 1048576 bytes, file number 9
New socket opened
Current: reno
connect_flag = 0
File Size: 1048576 bytes
From Server : OK
The client send 1048576 bytes, file number 10
```

```
Activities Terminal Dec 20 19:07 david@david-vm: ~/CLionProjects/tcp_cc
```

```
Listing...
A new client connection accepted
Received 1048576 bytes
Received 1mb completely, file number 5
Time to receive the file from the client was 1.010117 second
Listing...
Average time to get 5 files in TPC CC cubic is: 1.010967
A new client connection accepted
Received 1048576 bytes
Received 1mb completely, file number 1
Time to receive the file from the client was 1.010537 second
Listing...
A new client connection accepted
Received 1048576 bytes
Received 1mb completely, file number 2
Time to receive the file from the client was 1.010831 second
Listing...
A new client connection accepted
Received 1048576 bytes
Received 1mb completely, file number 3
Time to receive the file from the client was 1.010316 second
Listing...
A new client connection accepted
Received 1048576 bytes
Received 1mb completely, file number 4
Time to receive the file from the client was 1.011458 second
Listing...
A new client connection accepted
Received 1048576 bytes
Received 1mb completely, file number 5
Time to receive the file from the client was 1.010335 second
Listing...
Average time to get 5 files in TPC CC reno is: 1.010695
david@david-vm:~/CLionProjects/tcp_cc$
```

```
The client send 1048576 bytes, file number 4
New socket opened
Current: cubic
connect_flag = 0
File Size: 1048576 bytes
From Server : OK
The client send 1048576 bytes, file number 5
New socket opened
Current: reno
connect_flag = 0
File Size: 1048576 bytes
From Server : OK
The client send 1048576 bytes, file number 6
New socket opened
Current: reno
connect_flag = 0
File Size: 1048576 bytes
From Server : OK
The client send 1048576 bytes, file number 7
New socket opened
Current: reno
connect_flag = 0
File Size: 1048576 bytes
From Server : OK
The client send 1048576 bytes, file number 8
New socket opened
Current: reno
connect_flag = 0
File Size: 1048576 bytes
From Server : OK
The client send 1048576 bytes, file number 9
New socket opened
Current: reno
connect_flag = 0
File Size: 1048576 bytes
From Server : OK
The client send 1048576 bytes, file number 10
david@david-vm:~/CLionProjects/tcp_cc$
```

```

Activities Terminal Dec 20 19:09 en
david@david-vm: ~/CLionProjects/tcp_cc
david@david-vm:~/CLionProjects/tcp_cc$ sudo tc qdisc add dev lo root n
etern loss 10%
[sudo] password for david:
david@david-vm:~/CLionProjects/tcp_cc$ ./mainc
new socket opened
Bind() success
Waiting for incoming TCP-connections...
A new client connection accepted
Received 1048576 bytes
Received 1mb completely, file number 1
Time to receive the file from the client was 1.211257 second
Listing...
A new client connection accepted
Received 1048576 bytes
Received 1mb completely, file number 2
Time to receive the file from the client was 1.213419 second
Listing...
A new client connection accepted
Received 1048576 bytes
Received 1mb completely, file number 3
Time to receive the file from the client was 1.426104 second
Listing...
A new client connection accepted
Received 1048576 bytes
Received 1mb completely, file number 4
Time to receive the file from the client was 1.009977 second
Listing...
A new client connection accepted
Received 1048576 bytes
Received 1mb completely, file number 5
Time to receive the file from the client was 1.009823 second
Listing...
Average time to get 5 files in TPC CC cubic is: 1.174116
A new client connection accepted
Received 1048576 bytes
Received 1mb completely, file number 1
david@david-vm:~/CLionProjects/tcp_cc$ ./mainc
New socket opened
Current: cubic
connect_flag = 0
File Size: 1048576 bytes
From Server : OK
The client send 1048576 bytes, file number 1
New socket opened
Current: cubic
connect_flag = 0
File Size: 1048576 bytes
From Server : OK
The client send 1048576 bytes, file number 2
New socket opened
Current: cubic
connect_flag = 0
File Size: 1048576 bytes
From Server : OK
The client send 1048576 bytes, file number 3
New socket opened
Current: cubic
connect_flag = 0
File Size: 1048576 bytes
From Server : OK
The client send 1048576 bytes, file number 4
New socket opened
Current: cubic
connect_flag = 0
File Size: 1048576 bytes
From Server : OK
The client send 1048576 bytes, file number 5
New socket opened
Current: reno
connect_flag = 0
File Size: 1048576 bytes
From Server : OK
The client send 1048576 bytes, file number 6
New socket opened
Current: reno
connect_flag = 0
File Size: 1048576 bytes
From Server : OK
The client send 1048576 bytes, file number 7
New socket opened
Current: reno
connect_flag = 0
File Size: 1048576 bytes
From Server : OK
The client send 1048576 bytes, file number 8
New socket opened
Current: reno
connect_flag = 0
File Size: 1048576 bytes
From Server : OK
The client send 1048576 bytes, file number 9
New socket opened
Current: reno
connect_flag = 0
File Size: 1048576 bytes
From Server : OK
The client send 1048576 bytes, file number 10
david@david-vm:~/CLionProjects/tcp_cc$

```

```

Activities Terminal Dec 20 19:09 en
david@david-vm: ~/CLionProjects/tcp_cc
david@david-vm:~/CLionProjects/tcp_cc$
Listing...
A new client connection accepted
Received 1048576 bytes
Received 1mb completely, file number 5
Time to receive the file from the client was 1.009823 second
Listing...
Average time to get 5 files in TPC CC cubic is: 1.174116
A new client connection accepted
Received 1048576 bytes
Received 1mb completely, file number 1
Time to receive the file from the client was 1.010982 second
Listing...
A new client connection accepted
Received 1048576 bytes
Received 1mb completely, file number 2
Time to receive the file from the client was 1.461217 second
Listing...
A new client connection accepted
Received 1048576 bytes
Received 1mb completely, file number 3
Time to receive the file from the client was 1.009390 second
Listing...
A new client connection accepted
Received 1048576 bytes
Received 1mb completely, file number 4
Time to receive the file from the client was 1.009311 second
Listing...
A new client connection accepted
Received 1048576 bytes
Received 1mb completely, file number 5
Time to receive the file from the client was 10.642464 second
Listing...
Average time to get 5 files in TPC CC reno is: 3.026673
david@david-vm:~/CLionProjects/tcp_cc$
david@david-vm:~/CLionProjects/tcp_cc$
The client send 1048576 bytes, file number 4
New socket opened
Current: cubic
connect_flag = 0
File Size: 1048576 bytes
From Server : OK
The client send 1048576 bytes, file number 5
New socket opened
Current: reno
connect_flag = 0
File Size: 1048576 bytes
From Server : OK
The client send 1048576 bytes, file number 6
New socket opened
Current: reno
connect_flag = 0
File Size: 1048576 bytes
From Server : OK
The client send 1048576 bytes, file number 7
New socket opened
Current: reno
connect_flag = 0
File Size: 1048576 bytes
From Server : OK
The client send 1048576 bytes, file number 8
New socket opened
Current: reno
connect_flag = 0
File Size: 1048576 bytes
From Server : OK
The client send 1048576 bytes, file number 9
New socket opened
Current: reno
connect_flag = 0
File Size: 1048576 bytes
From Server : OK
The client send 1048576 bytes, file number 10
david@david-vm:~/CLionProjects/tcp_cc$

```



```

Activities Terminal Dec 20 19:11 en
david@david-vm: ~/CLionProjects/tcp_cc
david@david-vm:~/CLionProjects/tcp_cc$ sudo tc qdisc add dev lo root n
david@david-vm:~/CLionProjects/tcp_cc$ ./main5
new socket opened
Bind() success
Waiting for incoming TCP-connections...
A new client connection accepted
Received 1048576 bytes
Received 1mb completely, file number 1
Time to receive the file from the client was 1.009537 second
Listing...
A new client connection accepted
Received 1048576 bytes
Received 1mb completely, file number 2
Time to receive the file from the client was 1.009049 second
Listing...
A new client connection accepted
Received 1048576 bytes
Received 1mb completely, file number 3
Time to receive the file from the client was 3.808122 second
Listing...
A new client connection accepted
Received 1048576 bytes
Received 1mb completely, file number 4
Time to receive the file from the client was 11.612308 second
Listing...
A new client connection accepted
Received 1048576 bytes
Received 1mb completely, file number 5
Time to receive the file from the client was 1.494763 second
Listing...

Average time to get 5 files in TPC CC cubic is: 3.786756

A new client connection accepted
Received 1048576 bytes
Received 1mb completely, file number 1
Time to receive the file from the client was 1.215847 second
Listing...

david@david-vm:~/CLionProjects/tcp_cc$ ./mainc
New socket opened
Current: cubic
connect_flag = 0
File Size: 1048576 bytes
From Server : OK
The client send 1048576 bytes, file number 1
New socket opened
Current: cubic
connect_flag = 0
File Size: 1048576 bytes
From Server : OK
The client send 1048576 bytes, file number 2
New socket opened
Current: cubic
connect_flag = 0
File Size: 1048576 bytes
From Server : OK
The client send 1048576 bytes, file number 3
New socket opened
Current: cubic
connect_flag = 0
File Size: 1048576 bytes
From Server : OK
The client send 1048576 bytes, file number 4
New socket opened
Current: cubic
connect_flag = 0
File Size: 1048576 bytes
From Server : OK
The client send 1048576 bytes, file number 5
New socket opened
Current: reno
connect_flag = 0
File Size: 1048576 bytes
From Server : OK
The client send 1048576 bytes, file number 6
New socket opened
Current: reno
connect_flag = 0
File Size: 1048576 bytes
From Server : OK
The client send 1048576 bytes, file number 7
New socket opened
Current: reno
connect_flag = 0
File Size: 1048576 bytes
From Server : OK
The client send 1048576 bytes, file number 8
New socket opened
Current: reno
connect_flag = 0
File Size: 1048576 bytes
From Server : OK
The client send 1048576 bytes, file number 9
New socket opened
Current: reno
connect_flag = 0
File Size: 1048576 bytes
From Server : OK
The client send 1048576 bytes, file number 10

```

```

Activities Terminal Dec 20 19:11 en
david@david-vm: ~/CLionProjects/tcp_cc
david@david-vm:~/CLionProjects/tcp_cc$
Listing...
A new client connection accepted
Received 1048576 bytes
Received 1mb completely, file number 5
Time to receive the file from the client was 1.494763 second
Listing...

Average time to get 5 files in TPC CC cubic is: 3.786756

A new client connection accepted
Received 1048576 bytes
Received 1mb completely, file number 1
Time to receive the file from the client was 1.215847 second
Listing...
A new client connection accepted
Received 1048576 bytes
Received 1mb completely, file number 2
Time to receive the file from the client was 1.521869 second
Listing...
A new client connection accepted
Received 1048576 bytes
Received 1mb completely, file number 3
Time to receive the file from the client was 1.282994 second
Listing...
A new client connection accepted
Received 1048576 bytes
Received 1mb completely, file number 4
Time to receive the file from the client was 1.009848 second
Listing...
A new client connection accepted
Received 1048576 bytes
Received 1mb completely, file number 5
Time to receive the file from the client was 1.421720 second
Listing...

Average time to get 5 files in TPC CC reno is: 1.290456

david@david-vm:~/CLionProjects/tcp_cc$

The client send 1048576 bytes, file number 4
New socket opened
Current: cubic
connect_flag = 0
File Size: 1048576 bytes
From Server : OK
The client send 1048576 bytes, file number 5
New socket opened
Current: reno
connect_flag = 0
File Size: 1048576 bytes
From Server : OK
The client send 1048576 bytes, file number 6
New socket opened
Current: reno
connect_flag = 0
File Size: 1048576 bytes
From Server : OK
The client send 1048576 bytes, file number 7
New socket opened
Current: reno
connect_flag = 0
File Size: 1048576 bytes
From Server : OK
The client send 1048576 bytes, file number 8
New socket opened
Current: reno
connect_flag = 0
File Size: 1048576 bytes
From Server : OK
The client send 1048576 bytes, file number 9
New socket opened
Current: reno
connect_flag = 0
File Size: 1048576 bytes
From Server : OK
The client send 1048576 bytes, file number 10
david@david-vm:~/CLionProjects/tcp_cc$

```



```

Activities Terminal Dec 20 19:28 en
david@david-vm: ~/CLionProjects/tcp_cc
david@david-vm:~/CLionProjects/tcp_cc$ sudo tc qdisc add dev lo root n
etm loss 25%
david@david-vm:~/CLionProjects/tcp_cc$ ./mainc
new socket opened
Bind() success
Waiting for incoming TCP-connections...
A new client connection accepted
Received 1048576 bytes
Received 1mb completely, file number 1
Time to receive the file from the client was 25.616410 second
Listing...
A new client connection accepted
Received 1048576 bytes
Received 1mb completely, file number 2
Time to receive the file from the client was 1.011467 second
Listing...
A new client connection accepted
Received 1048576 bytes
Received 1mb completely, file number 3
Time to receive the file from the client was 15.713115 second
Listing...
A new client connection accepted
Received 1048576 bytes
Received 1mb completely, file number 4
Time to receive the file from the client was 5.109082 second
Listing...
A new client connection accepted
Received 1048576 bytes
Received 1mb completely, file number 5
Time to receive the file from the client was 10.560515 second
Listing...
Average time to get 5 files in TPC CC cubic is: 11.602118
A new client connection accepted
Received 1048576 bytes
Received 1mb completely, file number 1
Time to receive the file from the client was 1.009347 second
Listing...
david@david-vm:~/CLionProjects/tcp_cc$ ./mainc
New socket opened
Current: cubic
connect_flag = 0
File Size: 1048576 bytes
From Server : OK
The client send 1048576 bytes, file number 1
New socket opened
Current: cubic
connect_flag = 0
File Size: 1048576 bytes
From Server : OK
The client send 1048576 bytes, file number 2
New socket opened
Current: cubic
connect_flag = 0
File Size: 1048576 bytes
From Server : OK
The client send 1048576 bytes, file number 3
New socket opened
Current: cubic
connect_flag = 0
File Size: 1048576 bytes
From Server : OK
The client send 1048576 bytes, file number 4
New socket opened
Current: cubic
connect_flag = 0
File Size: 1048576 bytes
From Server : OK
The client send 1048576 bytes, file number 5
New socket opened
Current: reno
connect_flag = 0
File Size: 1048576 bytes
From Server : OK
The client send 1048576 bytes, file number 6
New socket opened
Current: reno
connect_flag = 0
File Size: 1048576 bytes
From Server : OK
The client send 1048576 bytes, file number 7
New socket opened
Current: reno
connect_flag = 0
File Size: 1048576 bytes
From Server : OK
The client send 1048576 bytes, file number 8
New socket opened
Current: reno
connect_flag = 0
File Size: 1048576 bytes
From Server : OK
The client send 1048576 bytes, file number 9
New socket opened
Current: reno
connect_flag = 0
File Size: 1048576 bytes
From Server : OK
The client send 1048576 bytes, file number 10
david@david-vm:~/CLionProjects/tcp_cc$

```

```

Activities Terminal Dec 20 19:28 en
david@david-vm: ~/CLionProjects/tcp_cc
david@david-vm:~/CLionProjects/tcp_cc$
Listing...
A new client connection accepted
Received 1048576 bytes
Received 1mb completely, file number 5
Time to receive the file from the client was 10.560515 second
Listing...
Average time to get 5 files in TPC CC cubic is: 11.602118
A new client connection accepted
Received 1048576 bytes
Received 1mb completely, file number 1
Time to receive the file from the client was 1.009347 second
Listing...
A new client connection accepted
Received 1048576 bytes
Received 1mb completely, file number 2
Time to receive the file from the client was 10.398687 second
Listing...
A new client connection accepted
Received 1048576 bytes
Received 1mb completely, file number 3
Time to receive the file from the client was 7.769213 second
Listing...
A new client connection accepted
Received 1048576 bytes
Received 1mb completely, file number 4
Time to receive the file from the client was 2.457075 second
Listing...
A new client connection accepted
Received 1048576 bytes
Received 1mb completely, file number 5
Time to receive the file from the client was 2.348356 second
Listing...
Average time to get 5 files in TPC CC reno is: 4.796536
david@david-vm:~/CLionProjects/tcp_cc$

```


30% איבוד:

```
Activities Terminal Dec 20 12:18
david@ubuntu: ~/CLionProjects/tcp_cc
new socket opened
Bind() success
Waiting for incoming TCP-connections...
A new client connection accepted
Received 1048576 bytes
Received 1mb completely, file number 1
Time to receive the file from the client was 13.999409 second
Listing...
A new client connection accepted
Received 1048576 bytes
Received 1mb completely, file number 2
Time to receive the file from the client was 3.990296 second
Listing...
A new client connection accepted
Received 1048576 bytes
Received 1mb completely, file number 3
Time to receive the file from the client was 23.047109 second
Listing...
A new client connection accepted
Received 1048576 bytes
Received 1mb completely, file number 4
Time to receive the file from the client was 3.858643 second
Listing...
A new client connection accepted
Received 1048576 bytes
Received 1mb completely, file number 5
Time to receive the file from the client was 32.768761 second
Listing...
Average time to get 5 files in TPC CC cubic is: 15.532844

New socket opened
Current: cubic
connect_flag = 0
File Size: 1048576 bytes
From Server : OK
The client send 1048576 bytes, file number 1
New socket opened
Current: cubic
connect_flag = 0
File Size: 1048576 bytes
From Server : OK
The client send 1048576 bytes, file number 2
New socket opened
Current: cubic
connect_flag = 0
File Size: 1048576 bytes
From Server : OK
The client send 1048576 bytes, file number 3
New socket opened
Current: cubic
connect_flag = 0
File Size: 1048576 bytes
From Server : OK
The client send 1048576 bytes, file number 4
New socket opened
Current: cubic
connect_flag = 0
File Size: 1048576 bytes
From Server : OK
The client send 1048576 bytes, file number 5
New socket opened
```

```
A new client connection accepted
Received 1048576 bytes
Received 1mb completely, file number 1
Time to receive the file from the client was 155.670779 second
Listing...
A new client connection accepted
Received 1048576 bytes
Received 1mb completely, file number 2
Time to receive the file from the client was 98.329702 second
Listing...
A new client connection accepted
Received 1048576 bytes
Received 1mb completely, file number 3
Time to receive the file from the client was 32.793283 second
Listing...
A new client connection accepted
Received 1048576 bytes
Received 1mb completely, file number 4
Time to receive the file from the client was 73.493421 second
Listing...
A new client connection accepted
Received 1048576 bytes
Received 1mb completely, file number 5
Time to receive the file from the client was 6.231357 second
Listing...
Average time to get 5 files in TPC CC reno is: 73.303708

connect_flag = 0
File Size: 1048576 bytes
From Server : OK
The client send 1048576 bytes, file number 6
New socket opened
Current: reno
connect_flag = 0
File Size: 1048576 bytes
From Server : OK
The client send 1048576 bytes, file number 7
New socket opened
Current: reno
connect_flag = 0
File Size: 1048576 bytes
From Server : OK
The client send 1048576 bytes, file number 8
New socket opened
Current: reno
connect_flag = 0
File Size: 1048576 bytes
From Server : OK
The client send 1048576 bytes, file number 9
New socket opened
Current: reno
connect_flag = 0
File Size: 1048576 bytes
From Server : OK
The client send 1048576 bytes, file number 10
```