Advanced Computer Networking (ACN)

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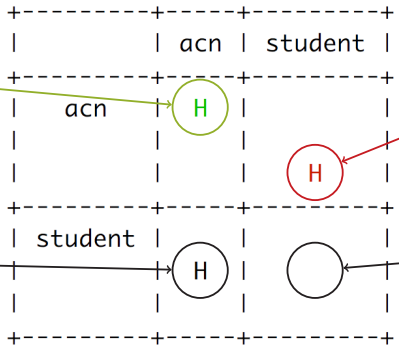
General Remarks

- Use the Moodle forum for discussion
- Compliance check of your implementations
  - If given a random test case, the client and server need to terminate with code 127
  - and print *"exited with code 127"*
- Binaries need to be executable outside the CI as well
  - We will test your implementations against each other and on real hardware
- The handshake for the first test case needs to be without a retry
- We use HTTP/3 and therefore h3 as ALPN

Success
Client and server application exited with error code 0 and the test results were verified.

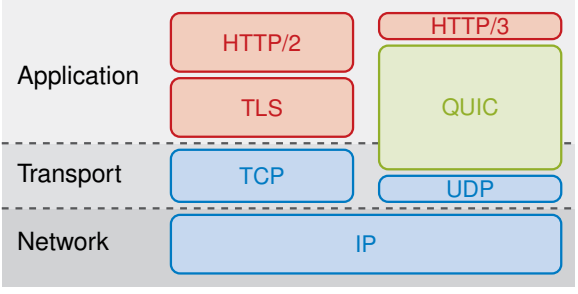
Error
Client and server application exited with error code > 0 or the test was verified as false.



Unsupported
The client or server implementation did not support the given testcase meaning returning with exit code 127.

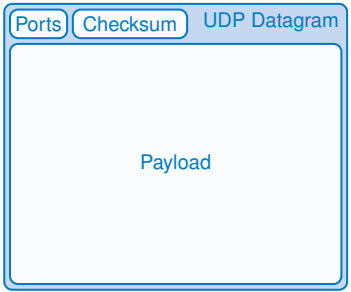
Not Compliant
The client or server implementation was not compliant. For example, they are missing or do not return with 127 on a random testcase.

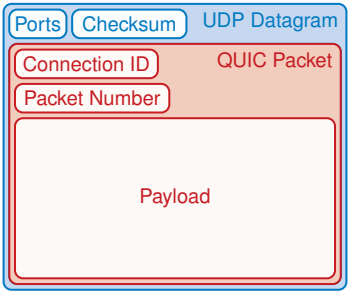
1a)

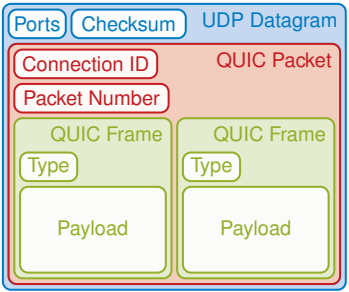

Application
Transport
Network
HTTP/2
TLS
HTTP/3
QUIC
TCP
UDP
IP

Project - Problem 1

1b)





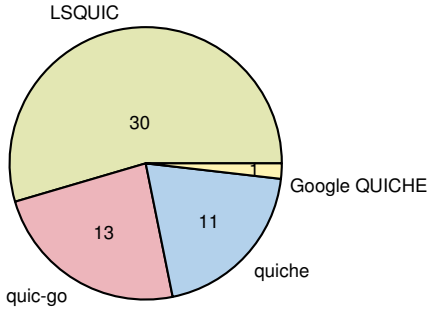


1c)

- Unilaterally declared parameters by each endpoint
- 17 different parameters exist in the specification
- Peers can e.g., set the initial size of the flow control window for the connection or streams, the maximum number of allowed streams, and options regarding connection migration
- Transport parameters **can** be send during the TLS handshake to authenticate values but can be **set** or **updated** later as well

1d)

Library	Supported Versions	Congestion Control Algorithms
LSQUIC	v1, draft-[29,27], Q[43,46,50]	Cubic, BBRv1, Adaptive
quic-go	v1, draft-29	Reno
quiche	v1, draft-[27-29]	Reno, Cubic, BBRv1, BBRv2
Google QUICHE	v1, v2, draft-29, Q50	Cubic, BBRv2



1e)

Client:

- The client can send data via a QUIC stream (similar to TCP: in order, reliable, and stream-oriented)
- QUIC splits the stream into chunks which are encoded as frames
- The frames are combined into QUIC packets, multiple frames can be included in one packet
- The whole QUIC packet is encrypted and header protection is applied
- The encrypted QUIC PDU is passed to the UDP interface, e.g. using `send()`

Server:

- A UDP datagram arrives on the bound UDP socket
- The connection ID is parsed and the packet can be assigned to a connection
- The header protection is removed and the payload is decrypted using the connection's session keys
- The frames are parsed and the data stream is reconstructed from the data chunks using the offset field
- The server application can read from that stream interface, as with TCP, and, for example, respond to the received data in the same stream

1f)

Example content of `/etc/hosts`

```
127.0.0.1       localhost
::1             localhost

127.0.0.1       server
```

Why can domain names be important for QUIC especially during the handshake?

- Domain names are used as Server Name Indication (SNI)
- Especially important if multiple QUIC servers are listening on the same IP address
- A QUIC Server might only accept a connection if the SNI matches the domain name in its certificate

1g)

Example content of `implementations.json`

```
{
        "implementation1": {
                "path": "/path/to/implementation1"
        },
        "implementation2": {
                "path": "/path/to/implementation2"
        }
}
```

Project - Problem 2
Interop Results

- We fetch all submissions and test some of their functionality against each other
- Results on the web page are updated on a daily basis
- The results can be seen on `https://acn.net.in.tum.de/interop`

	svm0145 lsquic	svm0645 quiche	svm0730 quic-go	svm1180 quiche	svm1220 quiche	svm1345 quic-go	svm1615 lsquic	svm1705 lsquic
svm0145 lsquic	H	H	H	H	H	H		H
svm0645 quiche	H	H	H	H	H	H		H
svm0730 quic-go	H	H	H	H	H	H		H
svm1180 quiche	H	H	H	H	H	H		H
svm1220 quiche	H	H	H	H	H	H		H
svm1345 quic-go	H	H	H	H	H	H		H
svm1615 lsquic								
svm1705 lsquic	H	H	H	H	H	H		H