S

Now you are an undergraduate student at SUSTech, briefly share your experience, no more than 100 words.

As an undergraduate student at SUSTech, I have had the opportunity to gain a strong foundation in computer science and engineering. I have taken a range of courses in subjects such as algorithms, data structures, and computer systems, and I have also had the opportunity to gain hands-on experience through internships and research projects. I have found the program at SUSTech to be challenging and rewarding, and I am grateful for the support and guidance of my professors and peers.

S

Do you think CS305: Computer Networking is a good course at SUSTech? Share your opinion within 100 words.

As an undergraduate student at SUSTech, I have taken the course CS305: Computer Networking and I believe it is an excellent course. The course provides a comprehensive introduction to the field of computer networking, covering topics such as networking protocols, network architecture, and network security. The professors are knowledgeable and engaging, and the course includes hands-on activities and projects that provide students with practical experience. Overall, I have found the CS305: Computer Networking course to be a valuable and enriching experience.

Welcome

CS305 Project Tutorial Session

Dec.11, 2022

Sixu Tan

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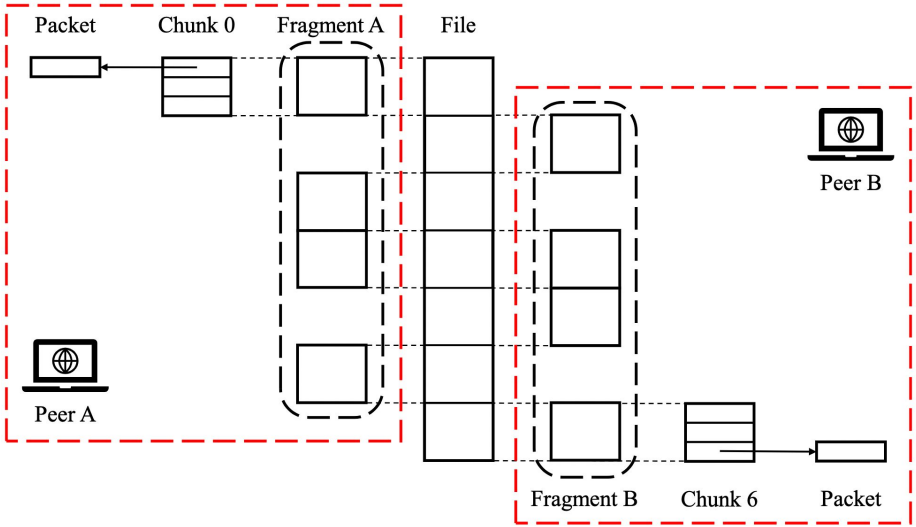
    a. P2P
    b. Congestion Control
    c. Concurrency
2. Provided Code
    a. Skeleton
    b. Network Simulator
    c. Testing script
3. Grading
4. Bonus
5. FAQ
6. Q&A

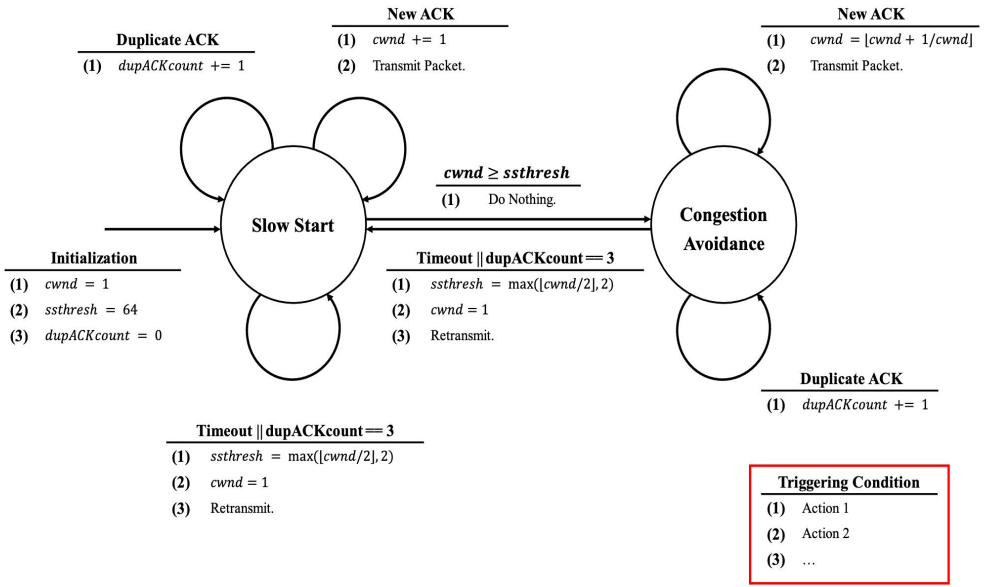
Content

Overview - P2P



- File is splitted into Chunks
- Each chunk is 512KB
- Each chunk is uniquely identified by its hash
- Each peer initially owns some chunks, named fragment
- A peer can download a chunk via a provided chunkhash

Overview - Congestion Control

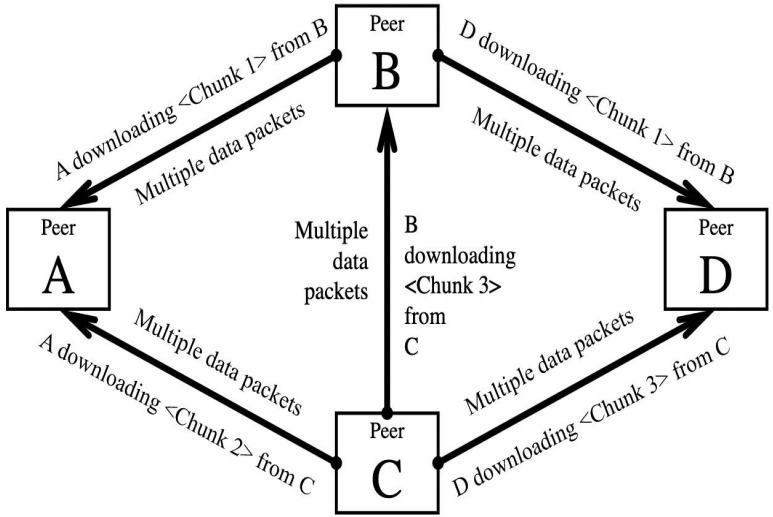


- window size is based on packet, not bytes.
- Ack the received Seq, not the wanted one.
- Only slow start, congestion avoidance, and fast retransmit. No fast recovery.
- Fast retransmit will be triggered at most **once** for a certain packet.

Overview - Concurrency

- **Concurrent**: You are watching a movie. Your boss urges you to work. You pause the movie, and go to work. After you finish the work, you resume the movie. This is concurrency.
- **Parralel**: You do the work while watching a movie.

- In this project, you need to implement concurrency.
- You need to concurrently download multiple chunks from multiple peers.
- You need to concurrently send chunks to multiple different peers.



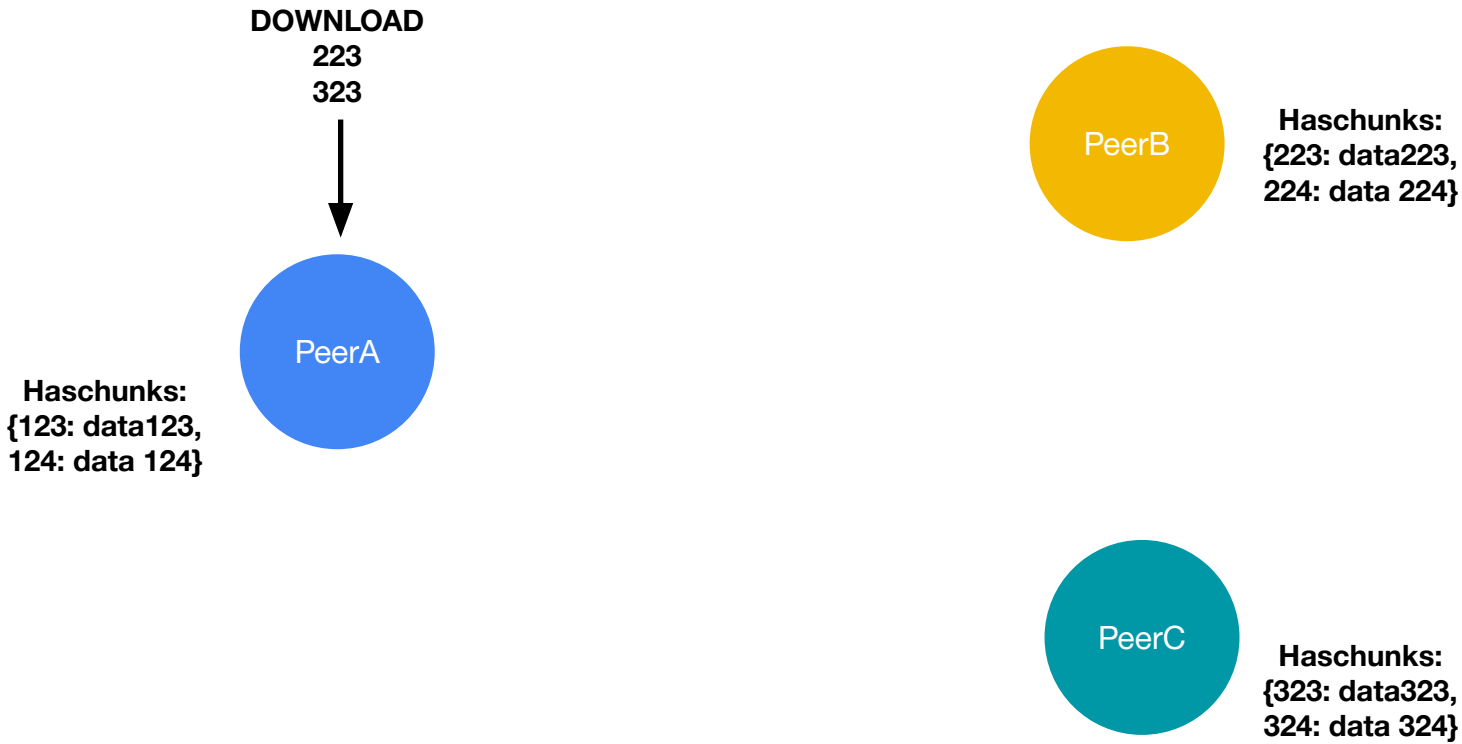
Overview - example

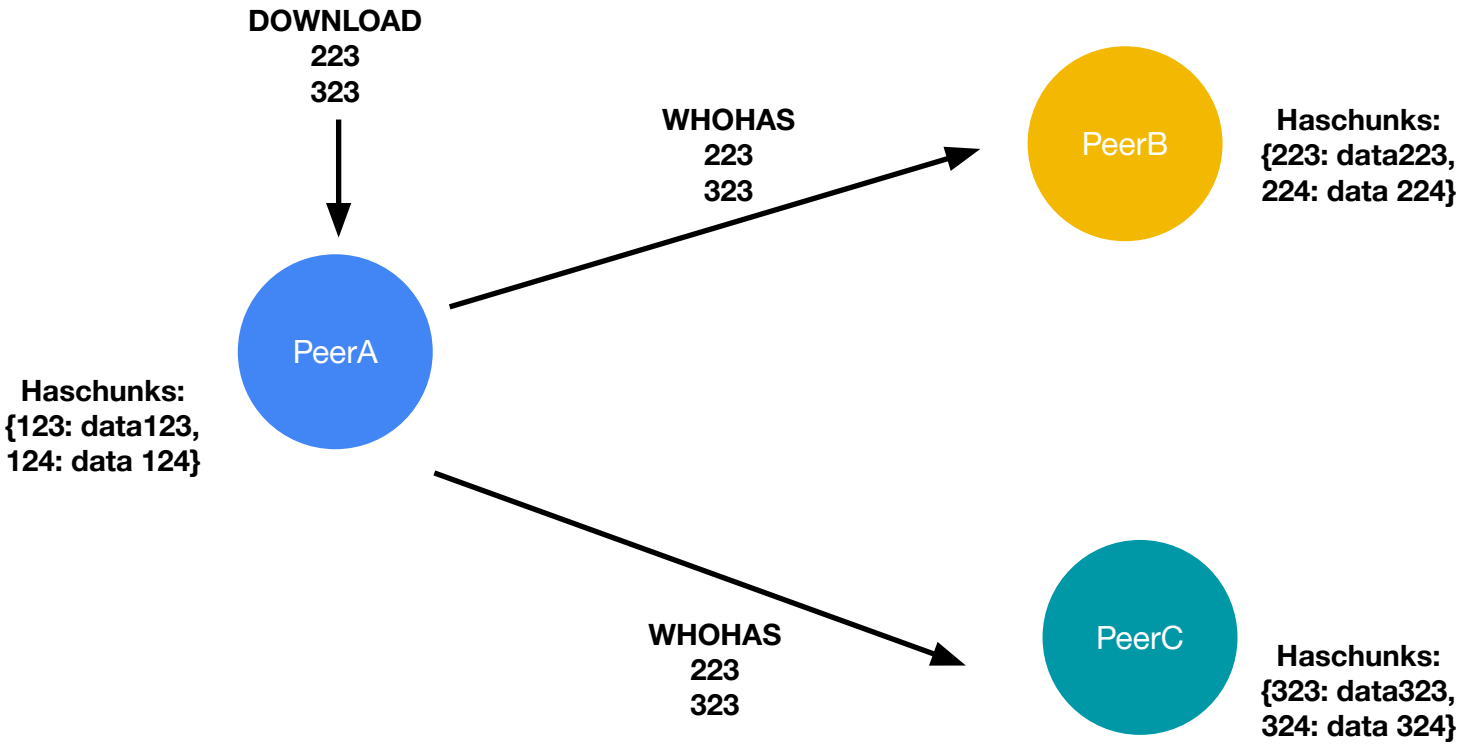
Haschunks:
{123: data123,
124: data 124}

Haschunks:
{223: data223,
224: data 224}

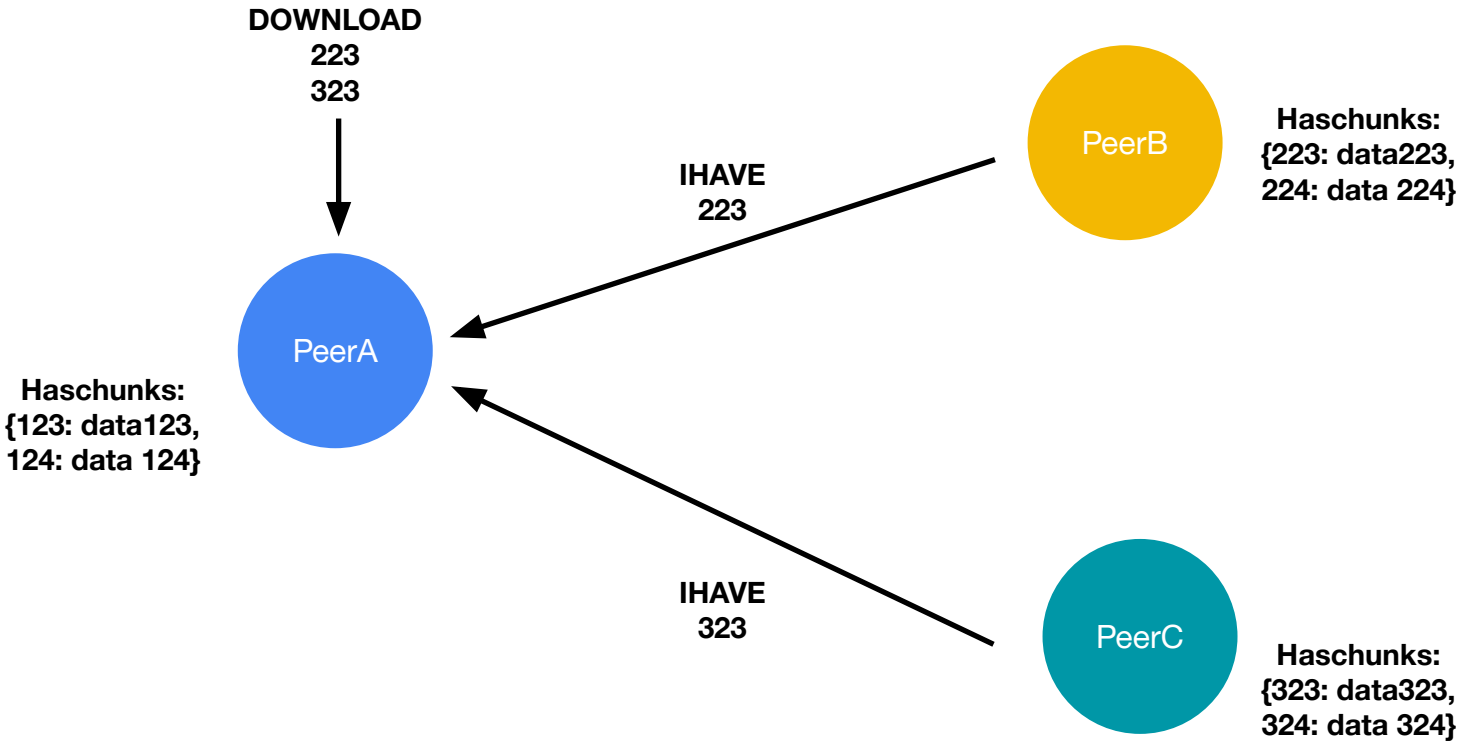
Haschunks:
{323: data323,
324: data 324}

Overview - example

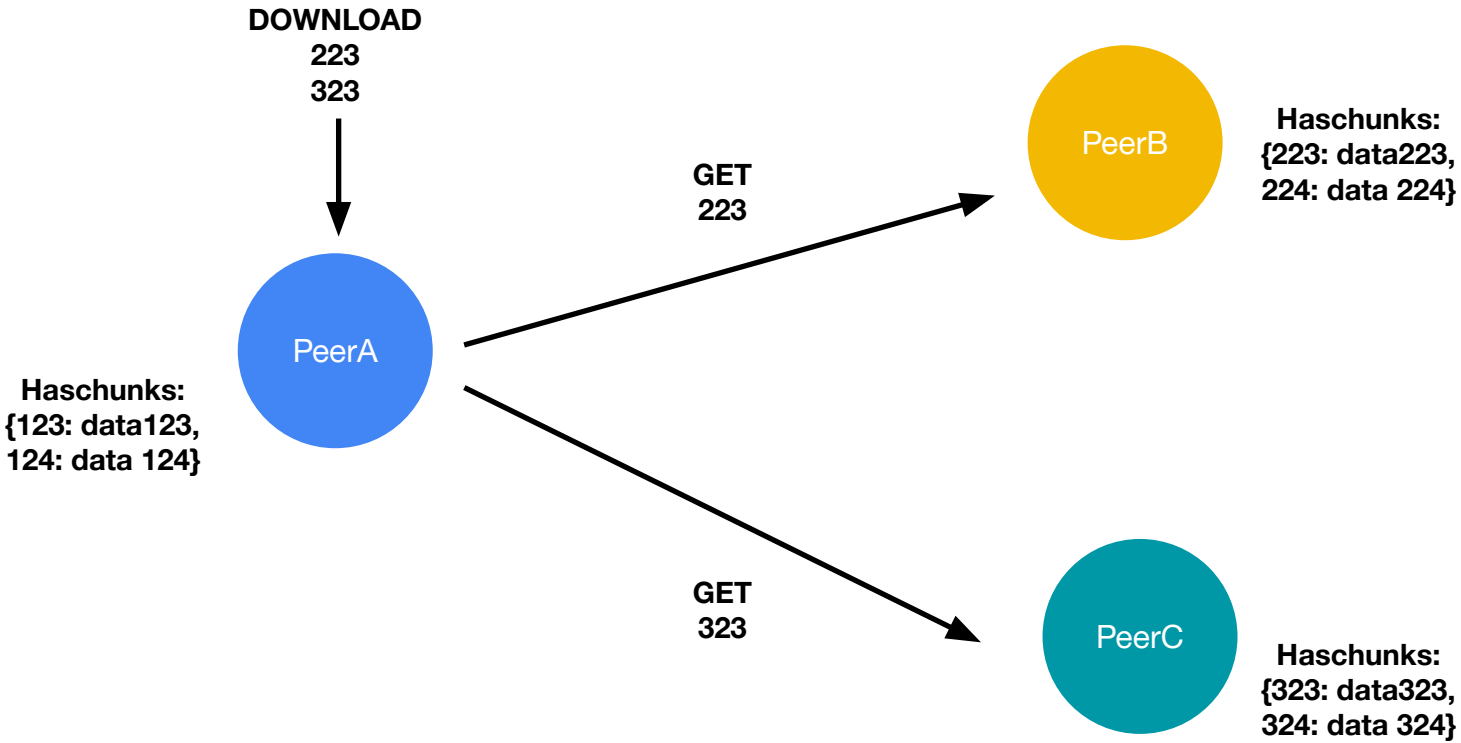



DOWNLOAD
223
323
PeerA
Haschunks:
{123: data123,
124: data 124}
WHOHAS
223
323
PeerB
Haschunks:
{223: data223,
224: data 224}
WHOHAS
223
323
PeerC
Haschunks:
{323: data323,
324: data 324}

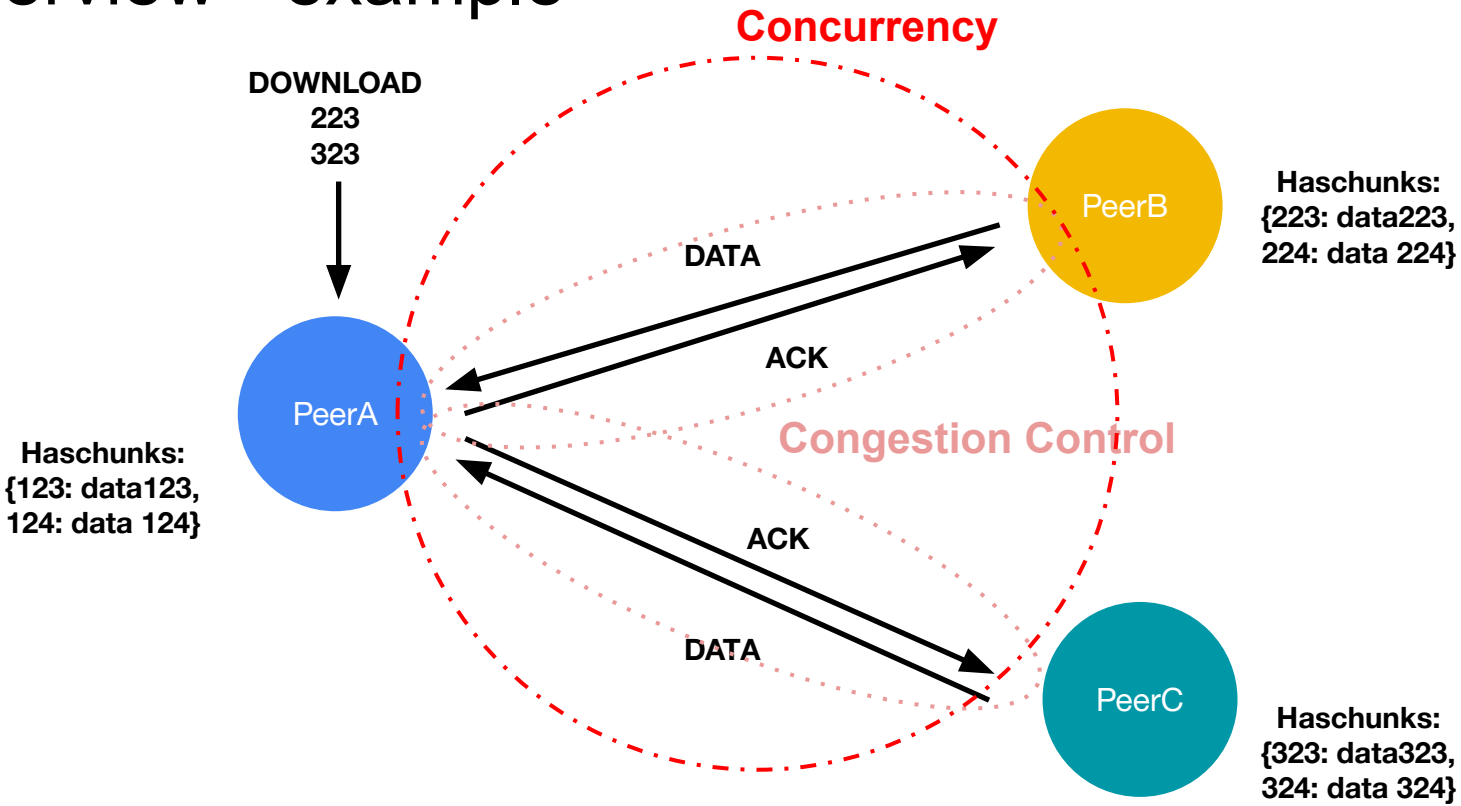
Overview - example



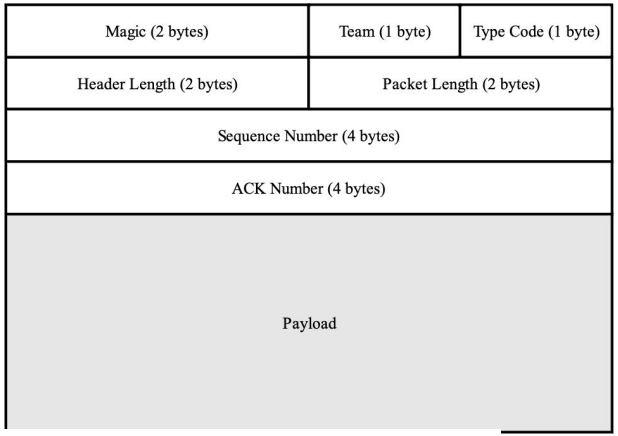
Overview - example



Overview - example



Overview - Packet Header



Packet Type	Type Code
WHOHAS	0
IHAVE	1
GET	2
DATA	3
ACK	4
DENIED	5

Fig. 1.3. Type codes

- Magic: Any (was for error detection)
- Team: You team number
- Extension of header is allowed, however, you cannot modify the existing fields.

Overview - Tasks

- P2P-like handshaking and RDT
- Congestion Control
- Concurrency and Robustness
- (Optional) Optimization

Content

Provided Code - File format

- chunkdata: 512KB of data
- chunkhash: 20 bytes sha-1 hash value of a certain chunkdata
- *.fragment: Serialized dictionary {chunkhash: chunkdata}
- *.chunkhash: Files that only contain chunkhashes: ex. master.chunkhash, download.chunkhash

```
class BtConfig:
    output_file: str                  # Not used
    peer_list_file: str               # Filename of peer list (including this peer)
    has_chunk_file: str               # Filename of serialized chunk dictionary
    max_conn: int                     # Maximum concurrently connections
    identity: int                     # This peer's ID
    peers: list[tuple[str, str, str]] # List of tuple (ID, hostname, port). Peer list
    haschunks: dict[str, bytes]       # Chunks data (hash -> data)
    verbose: int                      # Verbosity
    timeout: int                      # Timeout value, default 0.
                                      # If 0, you should estimate timeout value using estimated RTT.
                                      # If not 0, you should always use the set value.


    ip: str                           # This peer's IP
    port: int                         # This peer's port
```

Provided Code - Skeleton

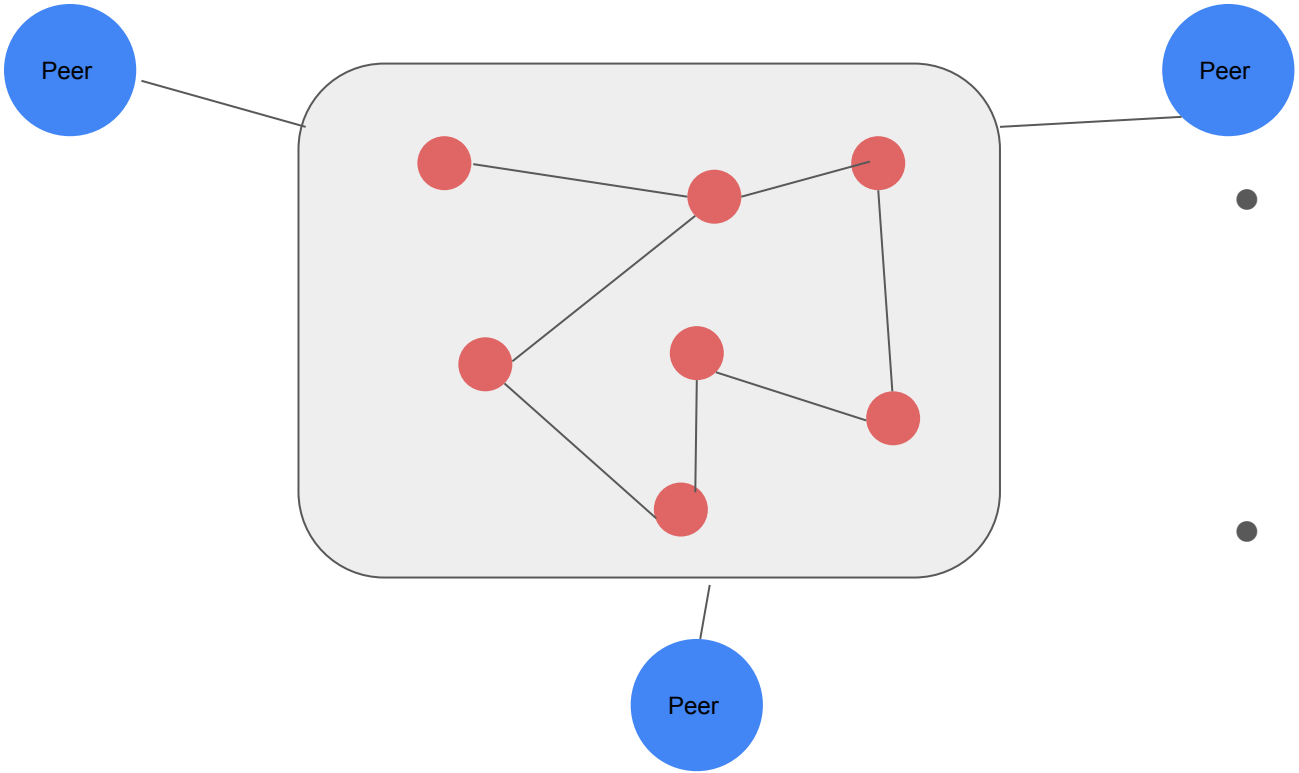
- It’s like a busy-waiting model.
- “select” multiplexes IO channels
- Alway use “simsocket”, it will direct packets to our simulator.

```
def peer_run(config):
    addr = (config.ip, config.port)
    sock = simsocket.SimSocket(config.identity, addr, verbose=config.verbose)

    try:
        while True:
            ready = select.select([sock, sys.stdin],[],[], 0.1)
            read_ready = ready[0]
            if len(read_ready) > 0:
                if sock in read_ready:
                    process_inbound_udp(sock)
                if sys.stdin in read_ready:
                    process_user_input(sock)
            else:
                # No pkt nor input arrives during this period
                pass
    except KeyboardInterrupt:
        pass
    finally:
        sock.close()
```

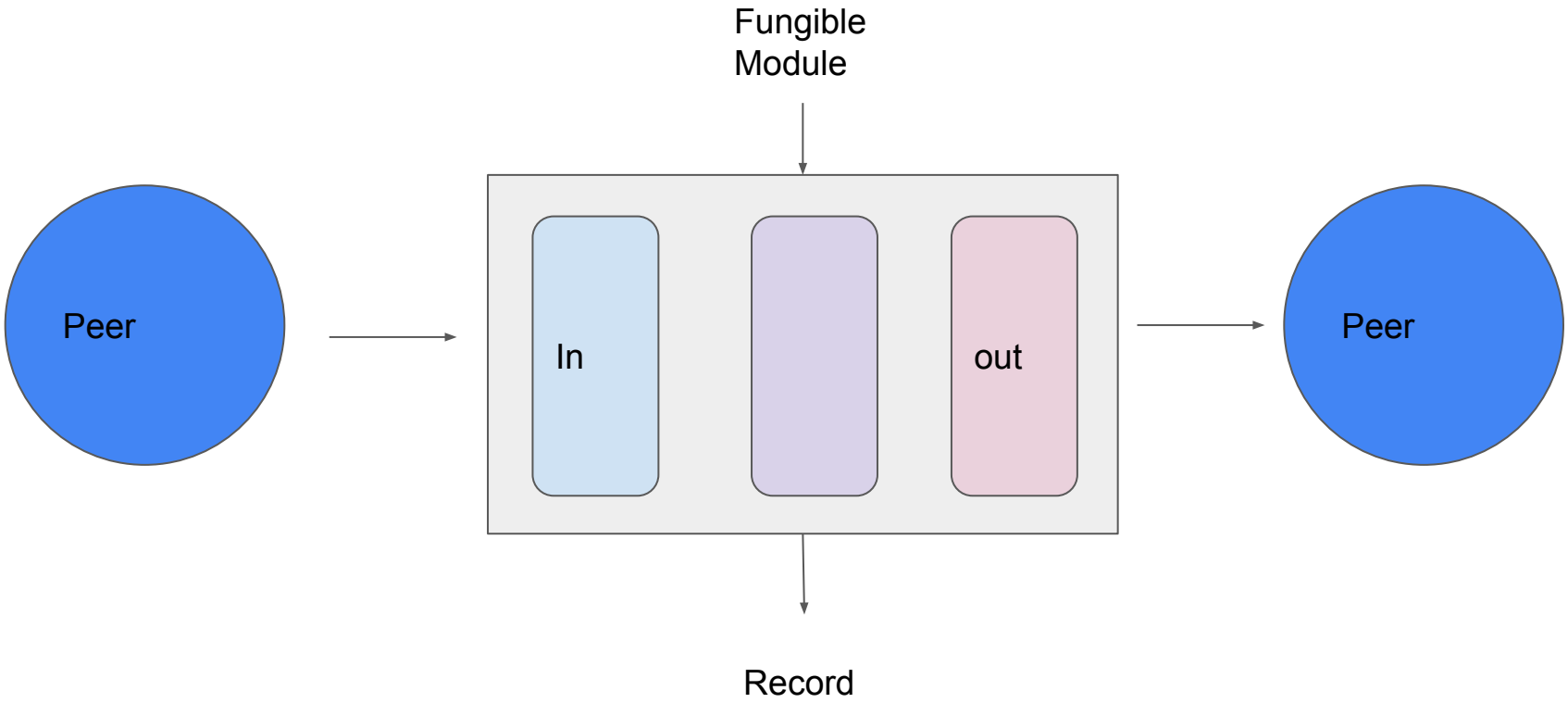
Peer.py

Provided Code - Network Simulator



- The simulator is actually a proxy, the env set in each peer will direct packets to the simulator first.
- Its topology is specified by *nodes.map*

Provided Code - Testing Scripts



Provided Code - Testing Scripts e.x.

```
def normal_handler(recv_queue, send_queue):
    start_time = time.time()
    while True:
        try:
            pkt = recv_queue.get(timeout=0.01)
        except:
            continue
        send_queue.put(pkt)
```

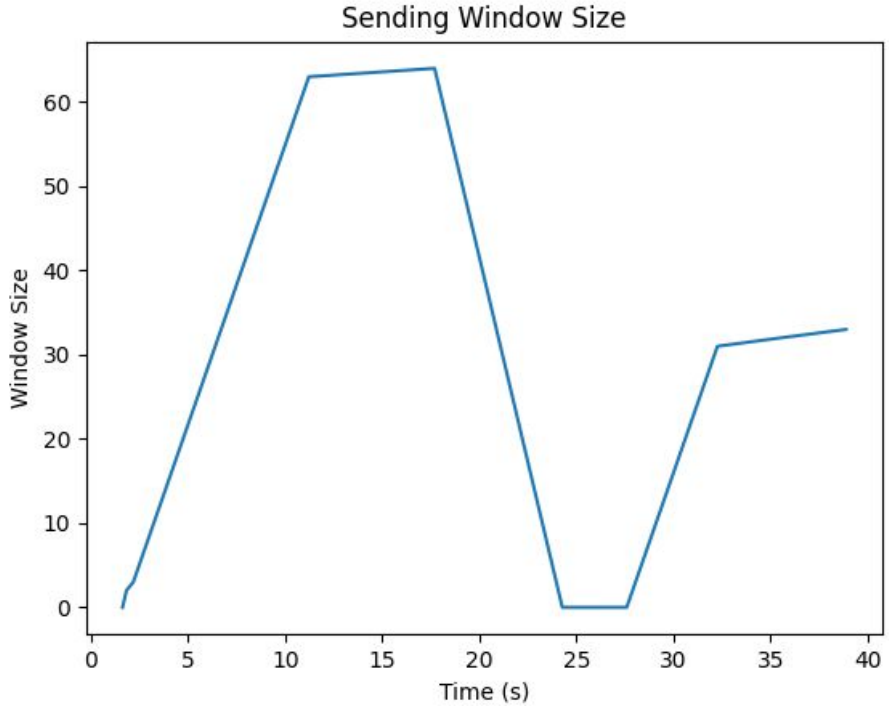
- This means you just let all packet pass.
- But you can also drop some of them in the middle…

Content

Grading

- Basic Test (sanity check) - 70 points
  - Handshaking - 12
  - RDT - 12
  - Congestion Control (Need to draw) - 22
  - Concurrency - 12
  - Robustness - 12
- Comprehensive Test (Run with simulator) - 30 points
  - Simple
  - Med
  - Complex
- Bonus - 20 points (Implement + ranking within participants)
  - Optimization

Grading - Draw



Content

Bonus - Optimization

You may consider the following directions to optimize:

- Higher utilization of bandwitth:
  - Fast recovery
- Less pacekts to retransmit:
  - Delayed ACK
  - Additional error recovery packet like QUIC
  - Hybrid of muktiple approach

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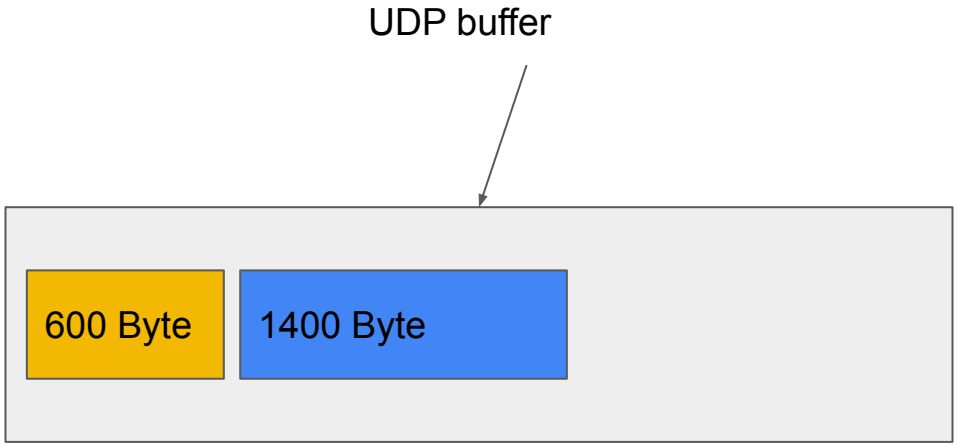
6. Q&A

FAQ - How to ask?

Walkthrough: how to post a discussion.

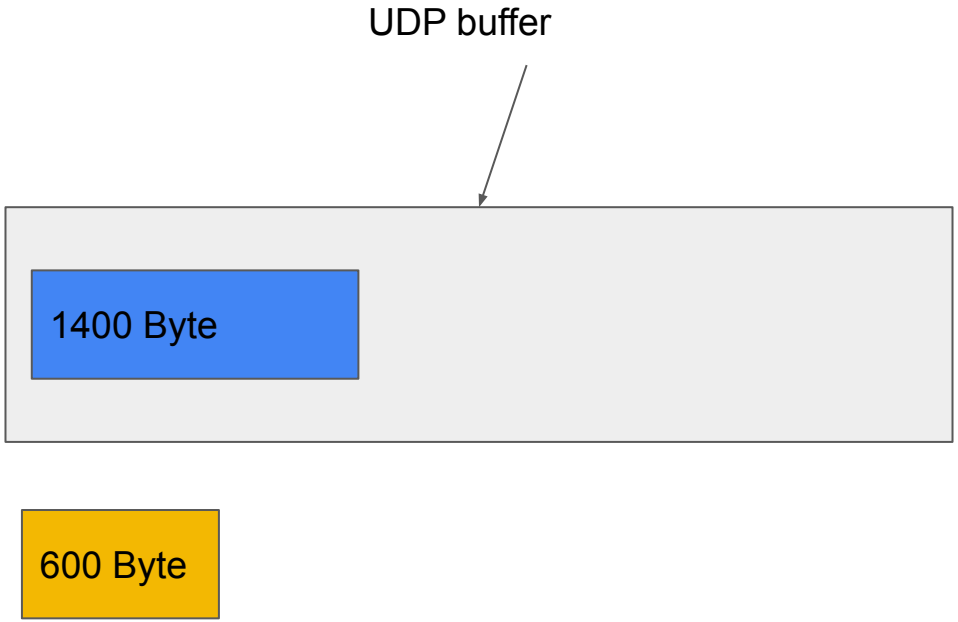
FAQ - udp recvfrom

- What will happen if call recvfrom(700)?



FAQ - udp recvfrom

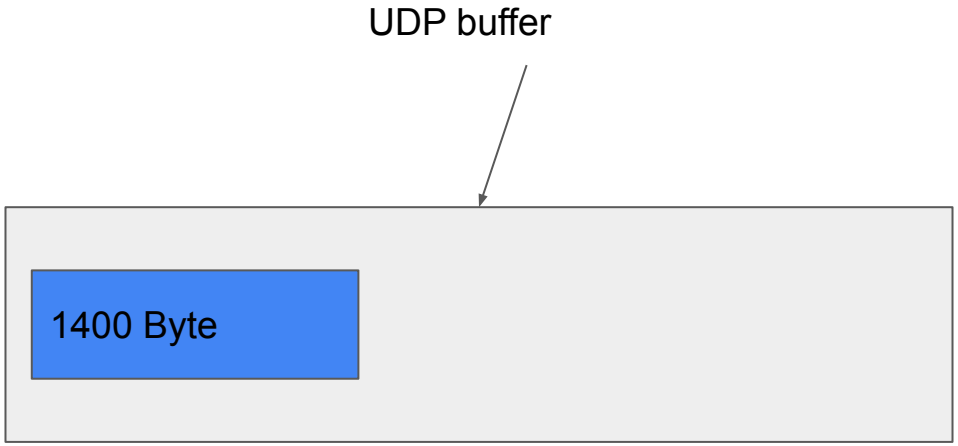
- What will happen if call recvfrom(700)?
  - Only get 600.



“Man, this packet only has 600 bytes! You can read at most **one** packet in a call!”

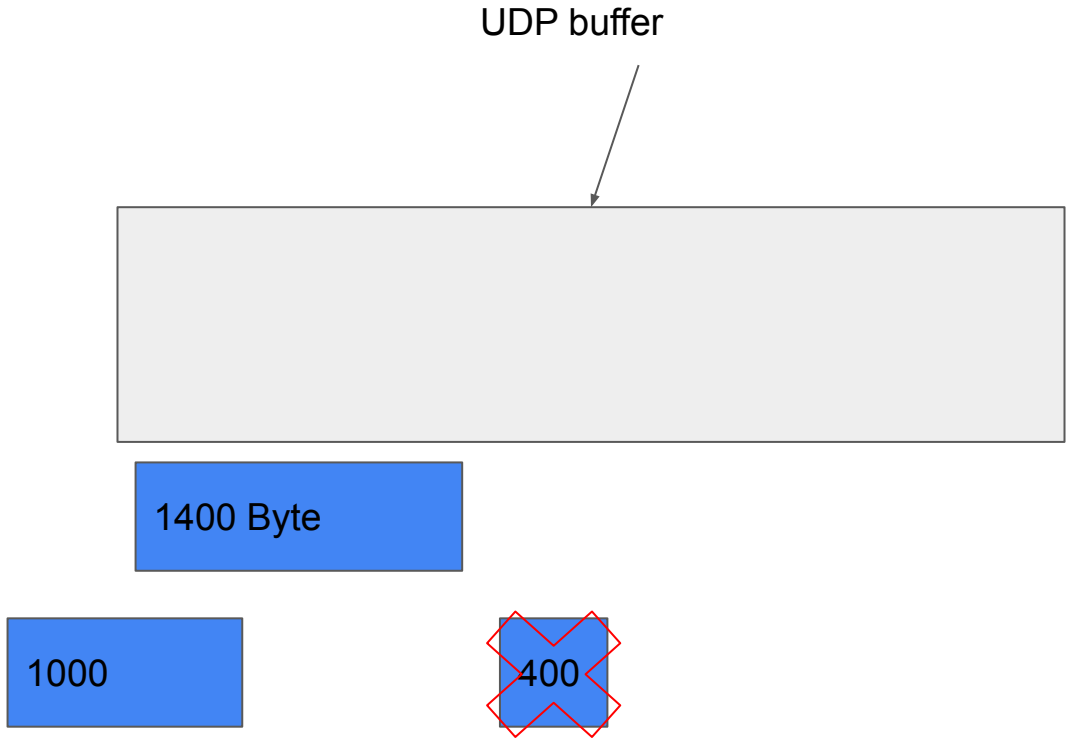
FAQ - udp recvfrom

- What will happen if call recvfrom(700)?
  - Only get 600.
- What will happen if call recvfrom(1000)?



FAQ - udp recvfrom

- What will happen if call recvfrom(700)?
  - Only get 600.
- What will happen if call recvfrom(1000)?
  - Read all 1400, return 1000, 400 discarded.



“OK, I am willing to cut myself and give you the first 1000K bytes.”

FAQ - Concurrency

- Maintain sessions!

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Q & A

Ask anything!

Checkpoints

- Checkpoint0: Nov.29th, release handshaking tests.
- Checkpoint1: Dec.12th, release reliable data transfer and congestion control tests.
- Checkpoint2: Dec.17th, release concurrency tests and comprehensive tests examples.
- Checkpoint3: Dec.22th, release robustness tests and optimization tests examples.

In-person Q&A service

- Dec.17 (SAT) 15:00-17:00, Haoming Zhang
- Dec.21 (WED) TBD, Sixu Tan
- Dec.22 (THU) TBD, Sixu Tan
- TBD, Zhiren Deng
- TBD

Thanks