St. Petersburg Institute
for Informatics and Automation
of the Russian Academy of Sciences

Architecture of data exchange with minimal client-server interaction in multipoint video conferencing

Anton Saveliev
SPIIRAS

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Main problems associated with streaming and processing of video data in video conferencing systems

- Need for greater channel bandwidth for video transmission
- High server load in client-server video conferencing systems
- High client load in peer-to-peer video conferencing systems
- Network Address Translation

Main advantages and disadvantages of peer-to-peer video conferencing systems

- Advantages:

  Low requirements for server hardware

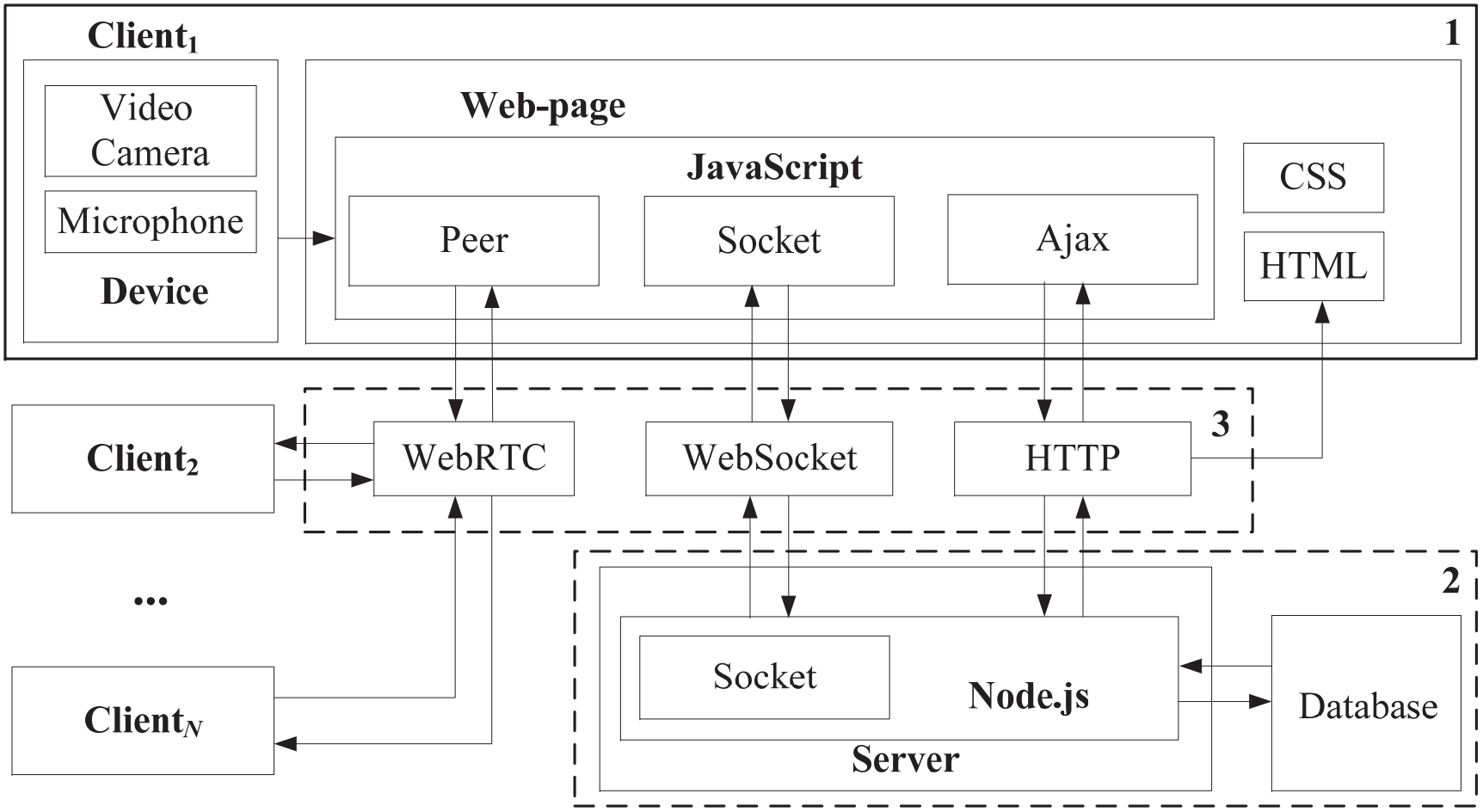
  Scalability

- Disadvantages:

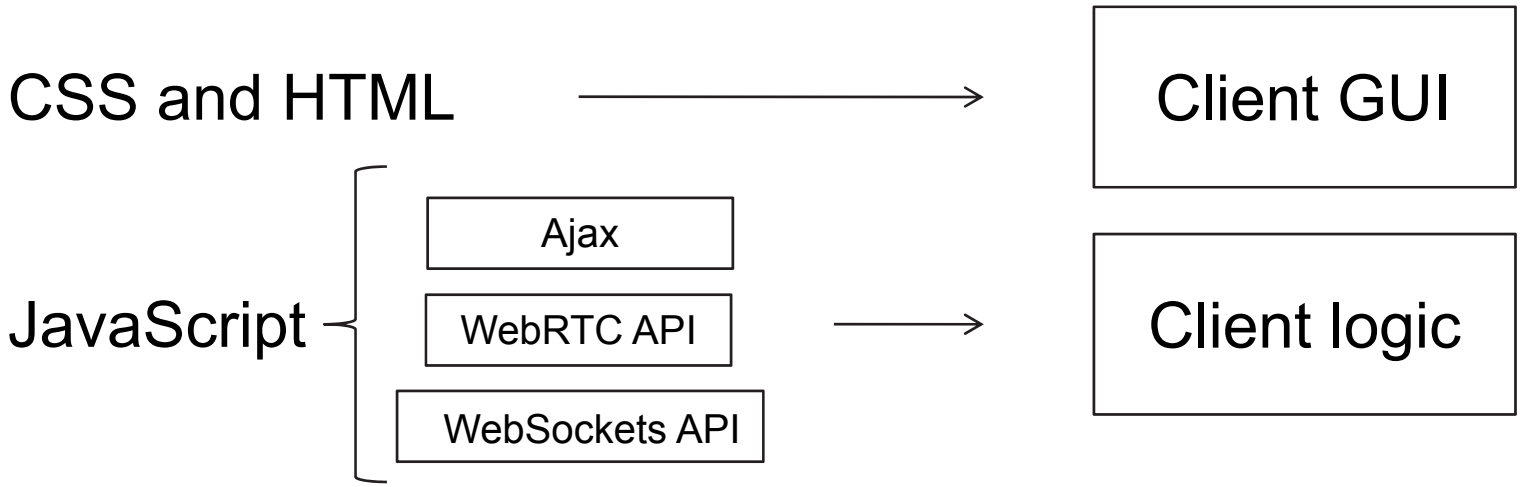
  High client load

  The complexity of the management of connected clients

Architecture of data exchange in the video conferencing application



Web page



The main web page functions:

- To create connections to the server
- To create connections to the clients
- To create, to process and to stream audio and video data

Server part

Node.js

MongoDB

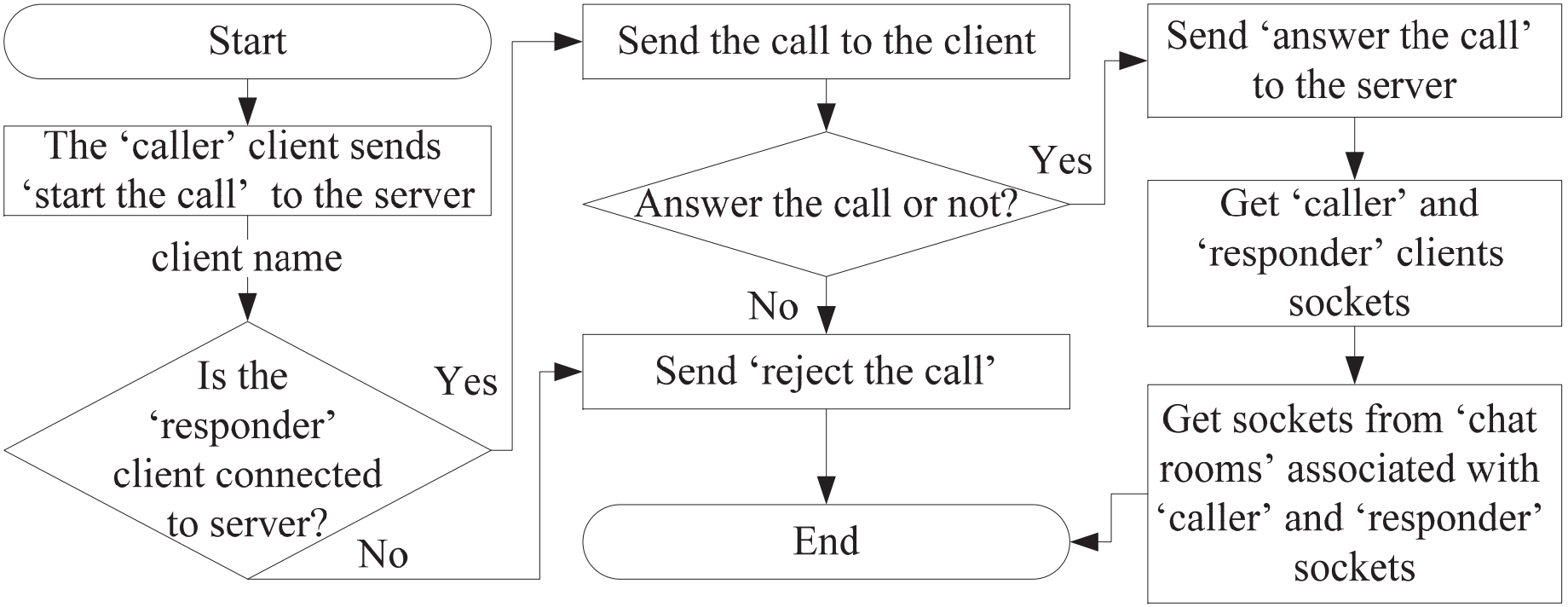
The main server functions:

- Building of the client-side applications
- Client registration
- Client authorization
- Chat rooms creation
- The ‘configuration message’ exchange between clients
- Working with the database

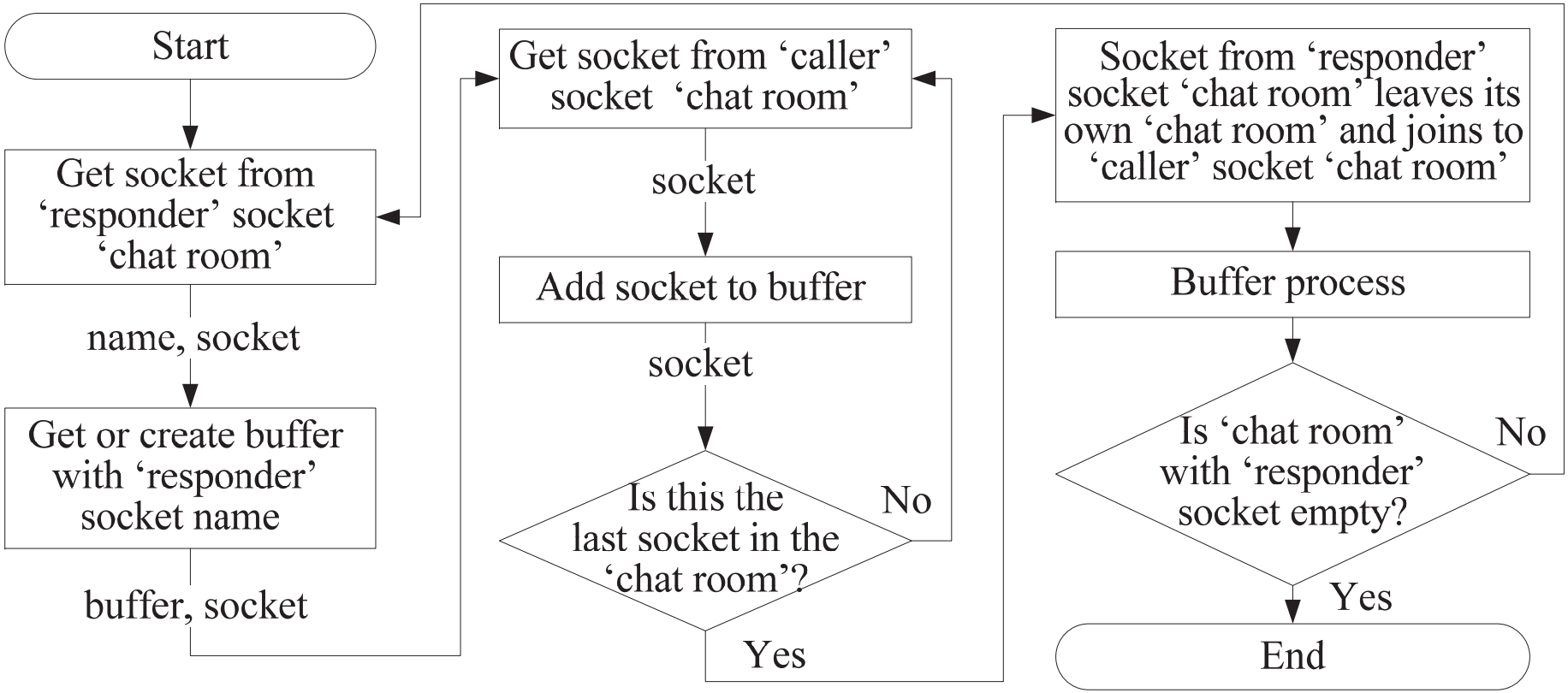
Protocols

- HTTP - transmission of web pages.
- WebScoket – transmission of ‘configuration messages’ between the clients and the server.
- WebRTC - streaming audio and video data between the clients.

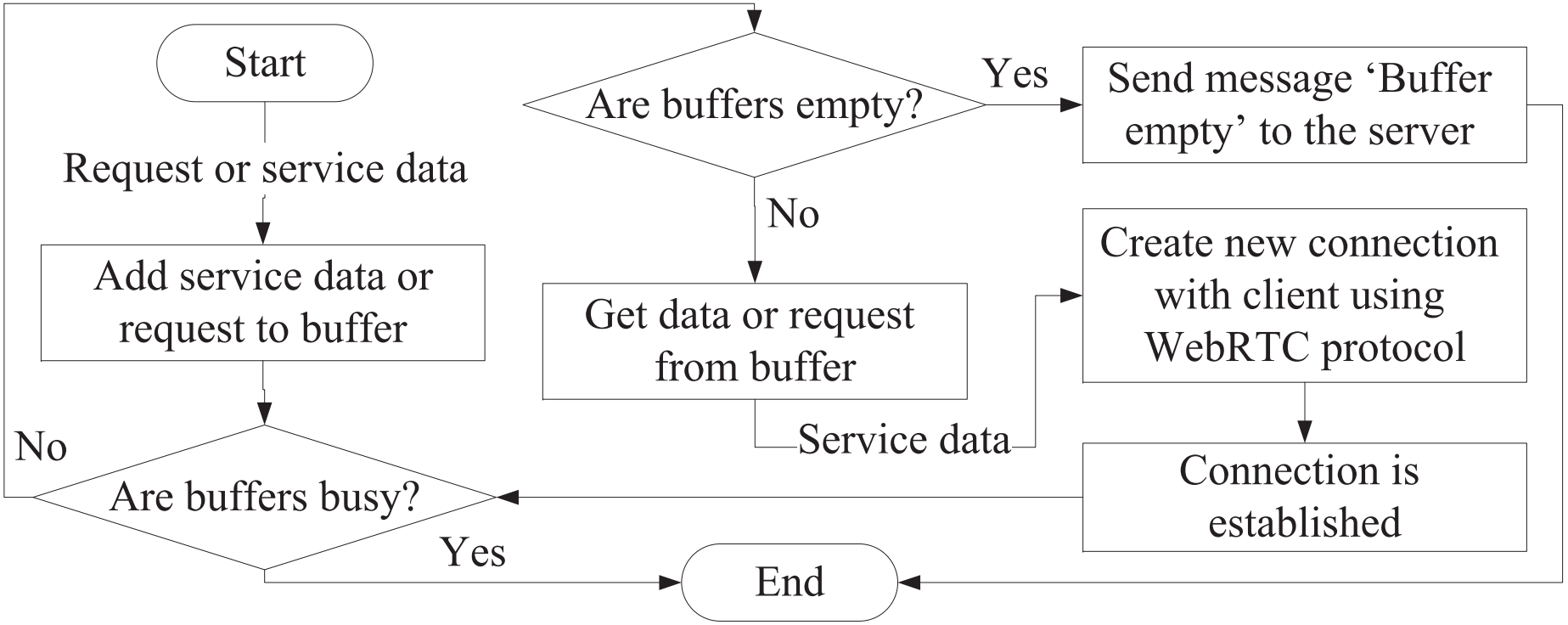
The algorithm of preparation of client parts before forming the 'configuration message'



The algorithm of allocation of sockets and processing their buffers on the server



The algorithm of working of data buffer on the client



Comparison of performance of the developed application and Skype

Modes of work of application client's part	RAM usage by client's part of the developed application	RAM usage by client part of the application "Skype"	CPU usage by client part of the developed application	CPU usage by client part of the "Skype" application
Verifying username and password mode	~ 8 000 Kb	~ 10 000 Kb	0%	1-2%
Standby mode	~ 11 000 Kb	~ 15 000 Kb	2-3%	2-4%
Mode of sending and receiving one audio and video stream	~ 17 000 Kb	~ 60 000 Kb	10-14%	12-15%
Mode of receiving four audio-video data streams and sending one audio-video data stream	~ 80 000 Kb	~ 250 000 Kb	25-40%	30-60%

Conclusion

- The architecture of the video conferencing application is asynchronous. It requires new data control algorithms for the connection via WebRTC protocol. During our research these algorithms were successfully developed and implemented in the application, which is capable:
  - to monitor of the status of clients connected to the group;
  - to support the group calls.

Further research will be focused on simplifying and improving the audio and video processing and transmission using peer-to-peer connections to optimize the data processing load between clients.

Thank you!

- Address: 39, 14 Line,

  St. Petersburg, Russia, 199178
- Phone/Fax : +7 (812) 3287081
- E-Mail: saveliev@iias.spb.su
- Web: www.spiiras.nw.ru/speech