

Teleconsultation using WebRTC

In ABDM-UHI, we have introduced 2 systems

- a) **EUA (End User Application)** – Used by any users mostly patients who wants to get consultation done digitally or physically
- b) **HSPA (Health Service Provider Application)** – Used by doctors who wants to provide services like Physical and Tele-consultation.

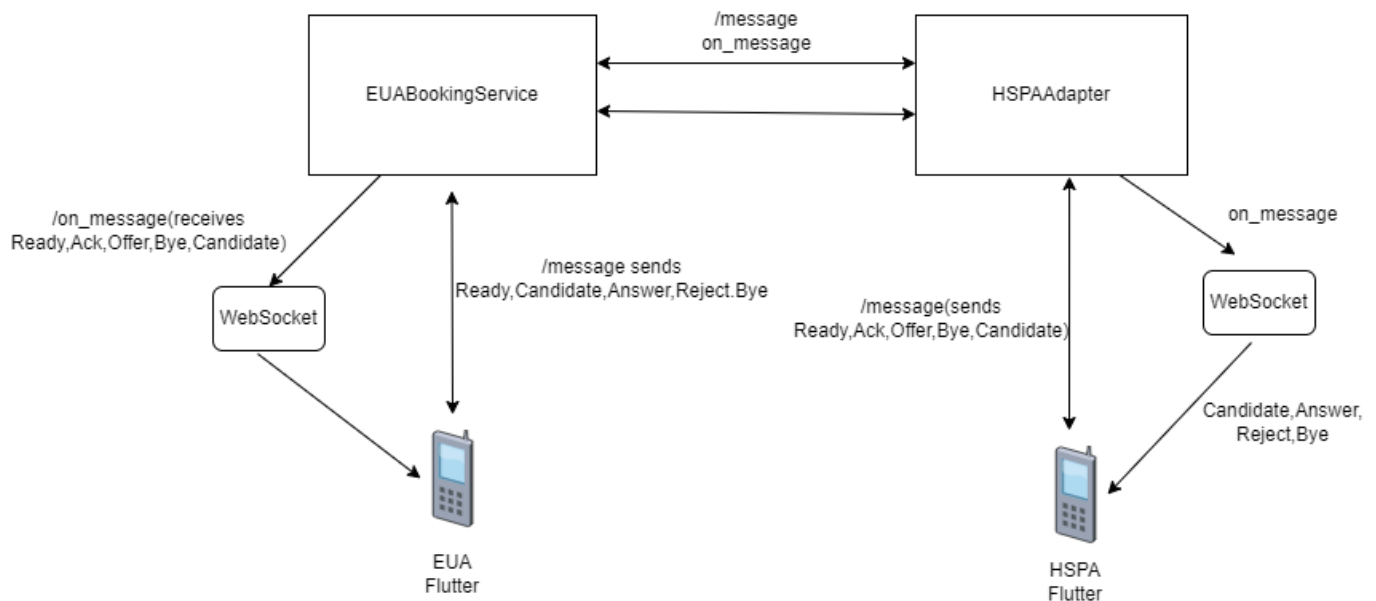
In above apps we have provided teleconsultation feature where patient can book teleconsultation appointment and then both patient and doctor can have video call and consultation can be done digitally.

To implement video call between EUA and HSPA we have used WebRTC which is used to create real time communication between 2 or 3 users.

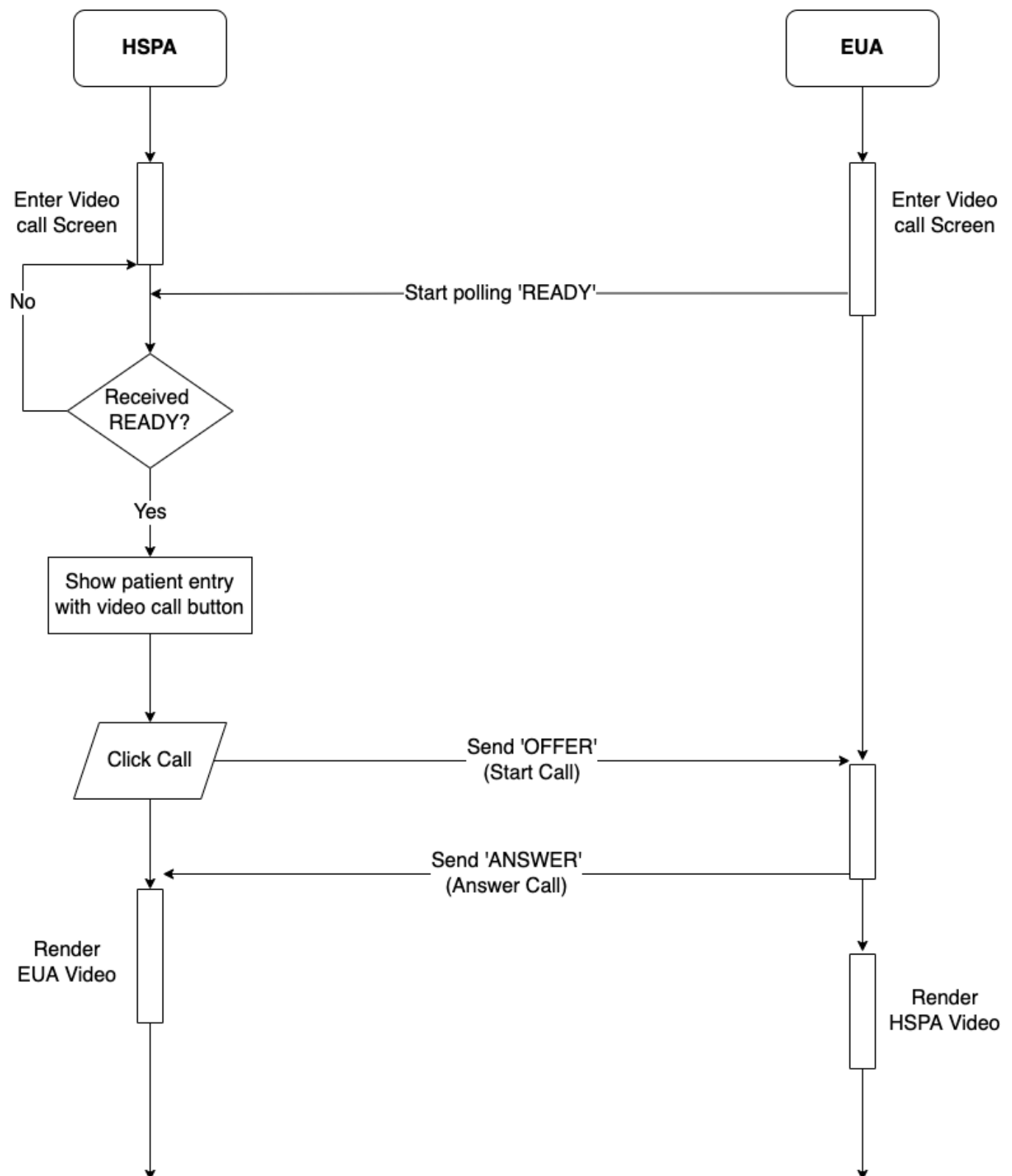
In UHI, we have tweaked the protocol (**on_message api**) a bit to allow a way in which any **HSPA/EUA** can connect with each other for a **video call**.

Communication happens via the **on_message api**.

This allows the process to be **interoperable** with any **HSPA/EUA** as long as they follow the protocols given below.



Detailed teleconsultation flow between HSPA and EUA



Step by step description of the flow diagram

1. Both doctor (HSPA) and patient (EUA) comes in waiting room and connected to socket where data can be send using message API and other party will get it in on_message API
2. Once socket connection established at patient side, app send **READY** state on message API
3. On HSPA side doctor receives the **READY** state for particular patient at his on_message callback and HSPA app can sends **ACK** state to the EUA app so that EUA app will stop sending its READY state again and again (EUA Stops Polling)
4. Now doctor can see patient name in waiting room along with the video button icon
5. Doctor clicks on Video call icon and HSPA app then sends **OFFER** to the EUA app along with addition details like sender, receiver and session details
6. On EUA side app gets **OFFER** and app show dialog to patient saying that doctor wants to connect
7. Once patient clicks on **Accept** button, EUA app sends **ANSWER** state along with patient details which can be used to render patient video in HSPA app
8. HSPA app receives **ANSWER** state from patient and call gets connected and doctor can see patient video at HSPA side and patient can see doctor's video on EUA app
9. Anyone in the call can end the teleconsultation by clicking on End Call button, Here **BYE** state will be sent to the other user and the call then get disconnected.

There are different types can be passed as below

type: 'CANDIDATE' | 'OFFER' | 'ANSWER' | 'READY' | 'BYE' | 'ACK'

Content of the message API will contain the following key value pairs

```
{
  "type": "OFFER",
  "data": {
    "to": "receiver_id",
    "from": "sender_id",
    "session_id": "common id for session",
    "media": "video",
    "description": "session_description_protocol_object_details"
  },
  "sender": "senderId"
}
```

Based on the type, values of **data** can be different.

Sample code to send an OFFEER

```
_send('OFFER', {
  'to': session.pid,
  'from': _selfId,
  'description': {'sdp': s.sdp, 'type': s.type},
  'session_id': session.sid,
  'media': media,
});
```

Sample code to send an ANSWER

```
_send('ANSWER', {
  'to': session.pid,
  'from': _selfId,
  'description': {'sdp': s.sdp, 'type': s.type},
  'session_id': session.sid,
});
```

Example for sending OFFER on Message API

```
{
  "context": {
    "domain": "nic2004:85111",
    "country": "IND",
    "city": "std:080",
    "action": "on_message",
    "timestamp": "2022-10-20T05:55:40.260138Z",
    "core_version": "0.7.1",
    "consumer_id": "https://exampleapp.io/",
    "consumer_uri":
"https://uhieuasandbox.abdm.gov.in/api/v1/bookingService/",
    "provider_uri": "https://hspasbx.abdm.gov.in/api/v1",
    "transaction_id": "642d5a60-4fa7-11ed-a230-c795d92f1fb3",
    "message_id": "d3a74240-503b-11ed-9531-1125182171fd"
  },
  "message": {
    "intent": {
      "chat": {
        "sender": {
          "person": {
            "name": "Ganesh Vikram Borse",
            "gender": "M",
            "image": "image2",
            "cred": "ganeshborse@hpr.ndhm"
          }
        }
      }
    }
  }
}
```

```

    },
    "receiver": {
        "person": {
            "name": "Manish Pravin Kahane",
            "gender": "M",
            "image": "image",
            "cred": "manishkahane1992@sbx"
        }
    },
    "content": {
        "content_id": "d3a74240-503b-11ed-9531-
1125182171fd",
        "content_value":
"{\"type\":\"OFFER\",\"data\":{\"to\":\"manishkahane1992@sbx\",\"from\":\"ganeshborse
@hpr.ndhm\",\"description\":{\"sdp\":{\"v=0\r\no=- 2866359230152942495 2 IN IP4
127.0.0.1\r\ns=-\r\nnt=0 0\r\nna=group:BUNDLE 0 1\r\nna=extmap-allow-
mixed\r\nna=msid-semantic: WMS 7c2f81c9-3bca-4e04-8081-a8eab5606edf\r\nnm=audio
9 UDP/TLS/RTP/SAVPF 111 63 103 104 9 102 0 8 106 105 13 110 112 113 126\r\nnc=IN IP4
0.0.0.0\r\nna=rtcp:9 IN IP4 0.0.0.0\r\nna=ice-ufraq:d4a/\r\nna=ice-
pwd:z8lphV1asFsLf1fH2WzmLTlh\r\nna=ice-options:trickle
renomination\r\nna=fingerprint:sha-256
50:99:D9:7C:26:8C:DE:C9:2E:EF:85:34:4F:3D:12:7D:B3:E3:9D:35:13:24:D9:9E:92:D7:5C:19:A
F:6D:32:4D\r\nna=setup:actpass\r\nna=mid:0\r\nna=extmap:1 urn:ietf:params:rtp-
hdnext:ssrc-audio-level\r\nna=extmap:2 http://www.webrtc.org/experiments/rtp-
hdnext/abs-send-time\r\nna=extmap:3 http://www.ietf.org/draft-holmer-rmcat-
transport-wide-cc-extensions-01\r\nna=extmap:4 urn:ietf:params:rtp-
hdnext:sdes:mid\r\nna=sendrecv\r\nna=msid:7c2f81c9-3bca-4e04-8081-a8eab5606edf
ffe6fdb7-4f64-4cee-b571-dd831d522dbb\r\nna=rtcp-mux\r\nna=rtpmap:111
opus/48000/2\r\nna=rtcp-fb:111 transport-cc\r\nna=fmtp:111
minptime=10;useinbandfec=1\r\nna=rtpmap:63 red/48000/2\r\nna=fmtp:63
111/111\r\nna=rtpmap:103 ISAC/16000\r\nna=rtpmap:104 ISAC/32000\r\nna=rtpmap:9
G722/8000\r\nna=rtpmap:102 ILBC/8000\r\nna=rtpmap:0 PCMU/8000\r\nna=rtpmap:8
PCMA/8000\r\nna=rtpmap:106 CN/32000\r\nna=rtpmap:105
CN/16000\r\nna=rtpmap:13 CN/8000\r\nna=rtpmap:110 telephone-
event/48000\r\nna=rtpmap:112 telephone-event/32000\r\nna=rtpmap:113 telephone-
event/16000\r\nna=rtpmap:126 telephone-event/8000\r\nna=ssrc:2486136228
cname:ccpvJW/c2QSZRw2w\r\nna=ssrc:2486136228 msid:7c2f81c9-3bca-4e04-8081-
a8eab5606edf ffe6fdb7-4f64-4cee-b571-dd831d522dbb\r\nna=ssrc:2486136228
mslabel:7c2f81c9-3bca-4e04-8081-a8eab5606edf\r\nna=ssrc:2486136228 label:ffe6fdb7-
4f64-4cee-b571-dd831d522dbb\r\nnm=video 9 UDP/TLS/RTP/SAVPF 96 97 98 99 127 124
35 36 108 109 125\r\nnc=IN IP4 0.0.0.0\r\nna=rtcp:9 IN IP4 0.0.0.0\r\nna=ice-
ufraq:d4a/\r\nna=ice-pwd:z8lphV1asFsLf1fH2WzmLTlh\r\nna=ice-options:trickle
renomination\r\nna=fingerprint:sha-256
50:99:D9:7C:26:8C:DE:C9:2E:EF:85:34:4F:3D:12:7D:B3:E3:9D:35:13:24:D9:9E:92:D7:5C:19:A
F:6D:32:4D\r\nna=setup:actpass\r\nna=mid:1\r\nna=extmap:14 urn:ietf:params:rtp-
hdnext:toffset\r\nna=extmap:2 http://www.webrtc.org/experiments/rtp-hdnext/abs-send-
time\r\nna=extmap:13 urn:3gpp:video-orientation\r\nna=extmap:3

```

```

http://www.ietf.org/id/draft-holmer-rmcat-transport-wide-cc-extensions-01\r\nna=extmap:5 http://www.webrtc.org/experiments/rtp-hdrext/playout-delay\r\nna=extmap:6 http://www.webrtc.org/experiments/rtp-hdrext/video-content-type\r\nna=extmap:7 http://www.webrtc.org/experiments/rtp-hdrext/video-timing\r\nna=extmap:8 http://www.webrtc.org/experiments/rtp-hdrext/color-space\r\nna=extmap:4 urn:ietf:params:rtp-hdrext:sdes:mid\r\nna=extmap:10 urn:ietf:params:rtp-hdrext:sdes:rtp-stream-id\r\nna=extmap:11 urn:ietf:params:rtp-hdrext:sdes:repaired-rtp-stream-id\r\nna=sendrecv\r\nna=msid:7c2f81c9-3bca-4e04-8081-a8eab5606edf ed2f96a9-7205-4cf7-a71f-ccea5b18f8dc\r\nna=rtcp-mux\r\nna=rtcp-rsize\r\nna=rtpmap:96 VP8/90000\r\nna=rtcp-fb:96 goog-remb\r\nna=rtcp-fb:96 transport-cc\r\nna=rtcp-fb:96 ccm fir\r\nna=rtcp-fb:96 nack\r\nna=rtcp-fb:96 nack pli\r\nna=rtpmap:97 rtx/90000\r\nna=fmtp:97 apt=96\r\nna=rtpmap:98 H264/90000\r\nna=rtcp-fb:98 goog-remb\r\nna=rtcp-fb:98 transport-cc\r\nna=rtcp-fb:98 ccm fir\r\nna=rtcp-fb:98 nack\r\nna=rtcp-fb:98 nack pli\r\nna=fmtp:98 level-asymmetry-allowed=1;packetization-mode=1;profile-level-id=42e01f\r\nna=rtpmap:99 rtx/90000\r\nna=fmtp:99 apt=98\r\nna=rtpmap:127 VP9/90000\r\nna=rtcp-fb:127 goog-remb\r\nna=rtcp-fb:127 transport-cc\r\nna=rtcp-fb:127 ccm fir\r\nna=rtcp-fb:127 nack\r\nna=rtcp-fb:127 nack pli\r\nna=rtpmap:124 rtx/90000\r\nna=fmtp:124 apt=127\r\nna=rtpmap:35 AV1/90000\r\nna=rtcp-fb:35 goog-remb\r\nna=rtcp-fb:35 transport-cc\r\nna=rtcp-fb:35 ccm fir\r\nna=rtcp-fb:35 nack\r\nna=rtcp-fb:35 nack pli\r\nna=rtpmap:36 rtx/90000\r\nna=fmtp:36 apt=35\r\nna=rtpmap:108 red/90000\r\nna=rtpmap:109 rtx/90000\r\nna=fmtp:109 apt=108\r\nna=rtpmap:125 ulpfec/90000\r\nna=ssrc-group:FID 3865892242 912108820\r\nna=ssrc:3865892242 cname:ccpvJW/c2QSZRw2w\r\nna=ssrc:3865892242 msid:7c2f81c9-3bca-4e04-8081-a8eab5606edf ed2f96a9-7205-4cf7-a71f-ccea5b18f8dc\r\nna=ssrc:3865892242 mslabel:7c2f81c9-3bca-4e04-8081-a8eab5606edf\r\nna=ssrc:3865892242 label:ed2f96a9-7205-4cf7-a71f-ccea5b18f8dc\r\nna=ssrc:912108820 cname:ccpvJW/c2QSZRw2w\r\nna=ssrc:912108820 msid:7c2f81c9-3bca-4e04-8081-a8eab5606edf ed2f96a9-7205-4cf7-a71f-ccea5b18f8dc\r\nna=ssrc:912108820 mslabel:7c2f81c9-3bca-4e04-8081-a8eab5606edf\r\nna=ssrc:912108820 label:ed2f96a9-7205-4cf7-a71f-ccea5b18f8dc\r\nn","type":"offer"},"session_id":"ganeshborse@hpr.ndhm-manishkahane1992@sbx","media":"video"},"sender":"ganeshborse@hpr.ndhm"},"content_type": "video_call_signalling", "content_url": ""
    },
    "time": {
      "timestamp": "2022-10-20T11:25:40"
    }
  }
}
}

```

Example for sending ANSWER on Message API

```
{
  "context": {
    "domain": "nic2004:85111",
    "country": "IND",
    "city": "std:080",
    "action": "on_message",
    "core_version": "0.7.1",
    "consumer_id": "eua-nha",
    "consumer_uri": "http://100.65.158.41:8901/api/v1/euaService",
    "message_id": "b1826a00-503b-11ed-bd03-0512d728e7dc",
    "timestamp": "2022-10-20T05:54:42.976915Z",
    "provider_uri": "https://hspasbx.abdm.gov.in/api/v1",
    "transaction_id": "642d5a60-4fa7-11ed-a230-c795d92f1fb3"
  },
  "message": {
    "intent": {
      "chat": {
        "sender": {
          "person": {
            "name": "Manish Pravin Kahane",
            "image": "sender base 64 encoded image",
            "cred": "manishkahane1992@sbx",
            "gender": "M"
          }
        },
        "receiver": {
          "person": {
            "name": "ganeshborse@hpr.ndhm - Ganesh
Vikram Borse",
            "image": "image",
            "cred": "ganeshborse@hpr.ndhm",
            "gender": "M"
          }
        }
      },
      "content": {
        "content_id": "b1826a00-503b-11ed-bd03-
0512d728e7dc",
        "content_value":
"{\"type\":\"ANSWER\",\"data\":{\"to\":\"ganeshborse@hpr.ndhm\",\"from\":\"\",\"description\":{\"sdp\":{\"v=0\\r\\no=- 2689742856308393717 2 IN IP4 127.0.0.1\\r\\ns=-\\r\\nt=0\\r\\na=group:BUNDLE 0 1\\r\\na=extmap-allow-mixed\\r\\na=msid-semantic: WMS c9b4a9dc-c31c-41f5-9b56-d7ace2300b81\\r\\nm=audio 9 UDP/TLS/RTP/SAVPF 111 63 103 104 9 102 0 8 106 105 13 110 112 113 126\\r\\nc=IN IP4 0.0.0.0\\r\\na=rtcp:9 IN IP4 0.0.0.0\\r\\na=ice-ufrag:eC88\\r\\na=ice-pwd:NfoJrG1JUdCDBUdBQY/1EHvv\\r\\na=ice-
```

options:trickle renomination\\r\\na=fingerprint:sha-256
30:B6:A2:DA:8F:89:5F:69:6B:F9:F9:97:96:F0:96:48:92:C9:4D:80:1D:BF:86:37:B0:31:2C:21:3D
:AF:8C:3F\\r\\na=setup:active\\r\\na=mid:0\\r\\na=extmap:1 urn:ietf:params:rtp-
hdrex:ssrc-audio-level\\r\\na=extmap:2 http://www.webrtc.org/experiments/rtp-
hdrex/abs-send-time\\r\\na=extmap:3 http://www.ietf.org/id/draft-holmer-rmcat-
transport-wide-cc-extensions-01\\r\\na=extmap:4 urn:ietf:params:rtp-
hdrex:sdes:mid\\r\\na=sendrecv\\r\\na=msid:c9b4a9dc-c31c-41f5-9b56-d7ace2300b81
f6f307a3-4955-4481-a144-d42868f32a66\\r\\na=rtcp-mux\\r\\na=rtpmap:111
opus/48000/2\\r\\na=rtcp-fb:111 transport-cc\\r\\na=fmtp:111
minptime=10;useinbandfec=1\\r\\na=rtpmap:63 red/48000/2\\r\\na=fmtp:63
111/111\\r\\na=rtpmap:103 ISAC/16000\\r\\na=rtpmap:104 ISAC/32000\\r\\na=rtpmap:9
G722/8000\\r\\na=rtpmap:102 ILBC/8000\\r\\na=rtpmap:0 PCMU/8000\\r\\na=rtpmap:8
PCMA/8000\\r\\na=rtpmap:106 CN/32000\\r\\na=rtpmap:105
CN/16000\\r\\na=rtpmap:13 CN/8000\\r\\na=rtpmap:110 telephone-
event/48000\\r\\na=rtpmap:112 telephone-event/32000\\r\\na=rtpmap:113 telephone-
event/16000\\r\\na=rtpmap:126 telephone-event/8000\\r\\na=ssrc:1501879733
cname:QA/b1cjnxL2WHyZc\\r\\nm=video 9 UDP/TLS/RTP/SAVPF 96 97 98 99 127 124 35 36
108 109 125\\r\\nc=IN IP4 0.0.0.0\\r\\na=rtcp:9 IN IP4 0.0.0.0\\r\\na=ice-
ufrag:eC88\\r\\na=ice-pwd:NfoJrG1JUdCDBUdBQY/1EHv\\r\\na=ice-options:trickle
renomination\\r\\na=fingerprint:sha-256
30:B6:A2:DA:8F:89:5F:69:6B:F9:F9:97:96:F0:96:48:92:C9:4D:80:1D:BF:86:37:B0:31:2C:21:3D
:AF:8C:3F\\r\\na=setup:active\\r\\na=mid:1\\r\\na=extmap:14 urn:ietf:params:rtp-
hdrex:toffset\\r\\na=extmap:2 http://www.webrtc.org/experiments/rtp-hdrex/abs-send-
time\\r\\na=extmap:13 urn:3gpp:video-orientation\\r\\na=extmap:3
http://www.ietf.org/id/draft-holmer-rmcat-transport-wide-cc-extensions-
01\\r\\na=extmap:5 http://www.webrtc.org/experiments/rtp-hdrex/playout-
delay\\r\\na=extmap:6 http://www.webrtc.org/experiments/rtp-hdrex/video-content-
type\\r\\na=extmap:7 http://www.webrtc.org/experiments/rtp-hdrex/video-
timing\\r\\na=extmap:8 http://www.webrtc.org/experiments/rtp-hdrex/color-
space\\r\\na=extmap:4 urn:ietf:params:rtp-hdrex:sdes:mid\\r\\na=extmap:10
urn:ietf:params:rtp-hdrex:sdes:rtp-stream-id\\r\\na=extmap:11 urn:ietf:params:rtp-
hdrex:sdes:repaired-rtp-stream-id\\r\\na=sendrecv\\r\\na=msid:c9b4a9dc-c31c-41f5-
9b56-d7ace2300b81 300138e5-80ad-47bf-b73e-47b2024932c0\\r\\na=rtcp-
mux\\r\\na=rtcp-rsize\\r\\na=rtpmap:96 VP8/90000\\r\\na=rtcp-fb:96 goog-
remb\\r\\na=rtcp-fb:96 transport-cc\\r\\na=rtcp-fb:96 ccm fir\\r\\na=rtcp-fb:96
ack\\r\\na=rtcp-fb:96 nack pli\\r\\na=rtpmap:97 rtx/90000\\r\\na=fmtp:97
apt=96\\r\\na=rtpmap:98 H264/90000\\r\\na=rtcp-fb:98 goog-remb\\r\\na=rtcp-fb:98
transport-cc\\r\\na=rtcp-fb:98 ccm fir\\r\\na=rtcp-fb:98 nack\\r\\na=rtcp-fb:98 nack
pli\\r\\na=fmtp:98 level-asymmetry-allowed=1;packetization-mode=1;profile-level-
id=42e01f\\r\\na=rtpmap:99 rtx/90000\\r\\na=fmtp:99 apt=98\\r\\na=rtpmap:127
VP9/90000\\r\\na=rtcp-fb:127 goog-remb\\r\\na=rtcp-fb:127 transport-cc\\r\\na=rtcp-
fb:127 ccm fir\\r\\na=rtcp-fb:127 nack\\r\\na=rtcp-fb:127 nack pli\\r\\na=rtpmap:124
rtx/90000\\r\\na=fmtp:124 apt=127\\r\\na=rtpmap:35 AV1/90000\\r\\na=rtcp-fb:35 goog-
remb\\r\\na=rtcp-fb:35 transport-cc\\r\\na=rtcp-fb:35 ccm fir\\r\\na=rtcp-fb:35
ack\\r\\na=rtcp-fb:35 nack pli\\r\\na=rtpmap:36 rtx/90000\\r\\na=fmtp:36
apt=35\\r\\na=rtpmap:108 red/90000\\r\\na=rtpmap:109 rtx/90000\\r\\na=fmtp:109
apt=108\\r\\na=rtpmap:125 ulpfec/90000\\r\\na=ssrc-group:FID 4249481809


```
2174264103\\r\\na=ssrc:4249481809 cname:QA/b1cjsxL2WHyZc\\r\\na=ssrc:2174264103
cname:QA/b1cjsxL2WHyZc\\r\\n\\",\"type\": \"answer\"},\"session_id\": \"ganeshborse@hpr
.ndhm-manishkahane1992@sbx\\\", \"sender\": \"manishkahane1992@sbx\\\"}\",
    \"content_type\": \"video_call_signalling\",
    \"content_url\": null,
    \"content_fileName\": null,
    \"content_filePath\": null
  },
  \"time\": {
    \"timestamp\": \"2022-10-20T11:24:42\"
  }
}
}
```

Points to keep in mind

- For teleconsultation, it is understood that only doctor initiates the call and patient is in waiting room.

Configuration required

We are using the [OpenRelay Free WebRTC Turn server](#) and googles STUN server for setting up the **RTCPeerConnection**

Recommended configuration:

How to use?

```
final Map<String, dynamic> _iceServers = {
  'iceServers': [
    {'url': 'stun:stun.l.google.com:19302'},
    {
      'urls': "turn:openrelay.metered.ca:80",
      'username': "openrelayproject",
      'credential': "openrelayproject",
    },
    {
      'urls': "turn:openrelay.metered.ca:443",
      'username': "openrelayproject",
      'credential': "openrelayproject",
    },
    {
      'urls': "turn:openrelay.metered.ca:443?transport=tcp",
      'username': "openrelayproject",
      'credential': "openrelayproject",
    },
  ],
};
```

An article on a sample webrtc integration

[WebRTC Video Chat App Development](#)