SIP   VoIP   RTP
Voice

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Design of Voice processing module Using RTP in VoIP system

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VoIP(Voice over IP) system   2   .   H.323
                    ,   SIP(Session Initiation Protocol)   . H.323
                              signaling   SIP
    RTT(Round Trip Time)   .   , LAN
                              .   SIP   ,
              RTP(Real-Time Transport Protocol)   RTCP(RTP Control Protocol)
                    .
    RTP
    ,   . , RTP
              RTP   ,
    PCM(Pulse Code Modulation), ADPCM(Adaptive Differential PCM)
                              RTP   RTCP   .

1.

VoIP   PSTN(Public Switched Telephone   RTP
Network)   .
    .   RTCP   RTP   QoS   ,
                              .
        VoIP   RTCP
                          ,   loss   .
ITU-T (International Telecommunication Union ?   SIP
Telecommunication Standardization Sector)   H.323   ,
                              , IETF(Internet   UAS(User Agent Server)   UAC(User Agent Client)
Engineering Task Force)   SIP   ,   RTP   RTCP
          . H.323   signal   .
                SIP   ,   PCM, ADPCM, LPC (Linear Predictive
                              Coding)   ,   RTP
      .   SIP   . UAS   UAC
              .   SIP   ,
          RTP   . VoIP   SIP   SDP   UAS   UAC
                              ,   ,
        RTP   . RTP   IETF RFC(Requests For   UAS   UAC
Comments) 1889   ,   .
                        . ,   2   RTP
RTP   UDP(User Datagram   , 3
Protocol)   ,   ,   . 4   ,
        , QoS(Quality of Service)   .
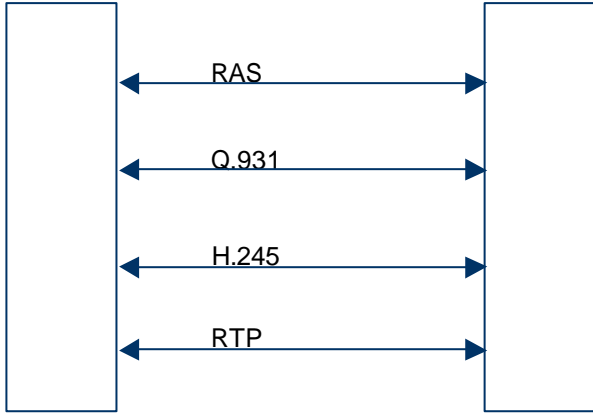
2.

2.1 H.323　　　　RTP

　H.323　　　　　　SIP　　　　　　. Gatekeeper
　　　　　　　　　　7　　　　　.
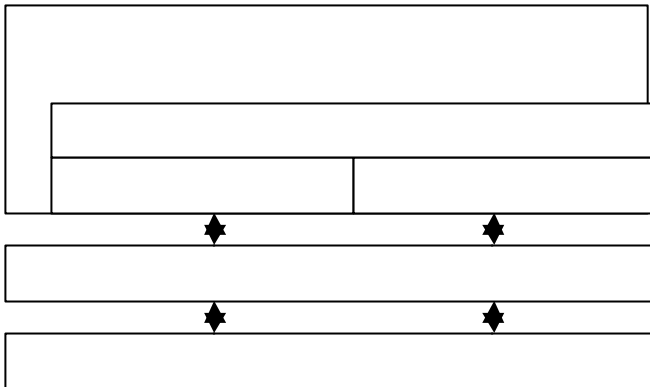　(1)Call admission: RAS(Registration/Admission/Status)
(H.225) (2)Call setup: Q.931 (3)Endpoint capability
negotiation and logical channel setup: H.245 (4)Stable
call: RTP (5)Channel closing: H.245 (6)Call
teardown: Q.931 (7)Call disengage: RAS(H.225)


```
        RAS

        Q.931

        H.245

        RTP
```

[　　1] H.323
　　　　　　RTP

　　　　　　RTT
　　　　. 　H.323
LAN

　　　　　　　　VoIP
　　　　　　　　　. 　　　　　　,
　　　　, 　　　, 　　　　.

　　, 　　　　　　　　　.

2.2 SIP　　　RTP

　SIP　　　　　　　　. 　INVITE,
RESPONSE, ACK 3-handshake
　, 　　　　　　　　　.

3.

3.1 RTP

[　2] RTP
　2　RTP　　　　　　　　,
　　　　RTP RTCP IP/UDP　　.
　　　　　　　RTP
. RTP
QoS　　　　　. 　,
　　　loss　　　　RTCP

　　　　　　　　.

3.2　　　　　　Architecture

　　　　　　　　　　　　.

OS : Windows 9x
Language : Visual C++
PC : IBM compatible

　　　　　　　　　　　　Windows
　　, 　　　MS Visual C++
　　. 　　　java
　　　　.
　　.
RTP packet　　　　　　Packet
　　.

0   31

| IP Header |
| UDP Header |
| V P X CC M PT Sequence Number |
| Timestamp |
| Synchronization Source ID |
| (first) Contributing Source ID |
| …….. |
| (last) Contributing Source ID |
| Application Data |
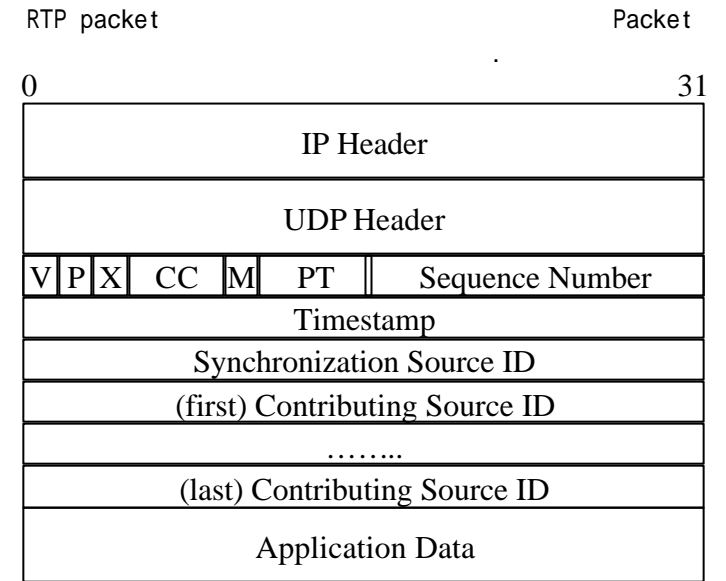
[　3] RTP

```
typedef struct {
  unsigned int version: 2;  /* protocol version */
  unsigned int p: 1;        /* padding flag */
  unsigned int x: 1;        /* header extension flag */
  unsigned int cc: 4;       /* CSRC count */
  unsigned int m: 1;        /* marker bit */
  unsigned int pt: 7;       /* payload type */
  u_int16 seq;      /* sequence number */
  u_int32 ts;       /* timestamp */
  u_int32 ssrc;          /* synchronization source */
  u_int32 csrc[1];    /* optional CSRC list */
};
```
　　　　sequence number　16　　　　,
　timestamp　32　　　　. 　　　RTP
　　　　　　, application data
　　　　　.
PCM, ADPCM, LPC　　　,
　　　　　　　　　RTP
　.

RTCP　　　4　　　　　　　
　.
```
typedef struct {
  rtcp_common common;    /* common header */
```
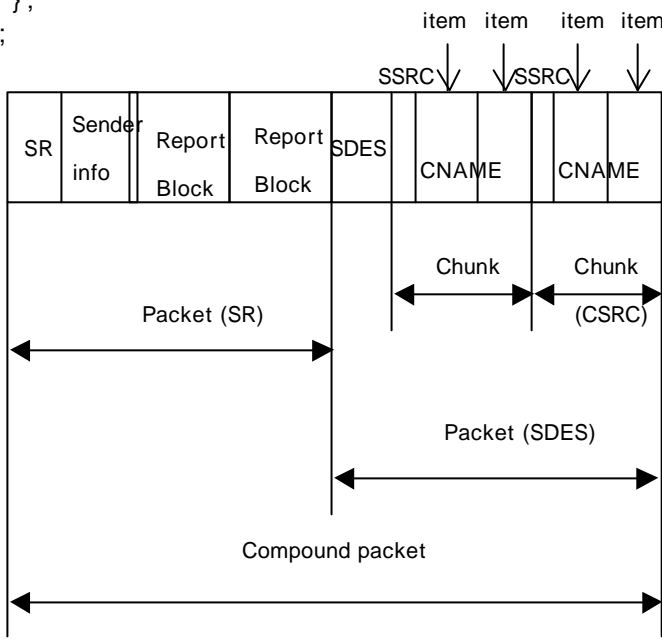
```c
union {
    struct { /* (SR) */
      u_int32 ssrc;
      u_int32 ntp_sec;        /* NTP timestamp */
      u_int32 ntp_frac;
      u_int32 rtp_ts;         /* RTP timestamp */
      u_int32 psent;          /* packets sent */
      u_int32 osent;          /* octets sent */
      rtcp_rr_t rr[1]; /* variable-length list */
    };
    struct { /* (RR) */
      u_int32 ssrc; /* generating report */
      rtcp_rr_t rr[1]; /* variable-length list */
    };
    struct { /* BYE */
      u_int32 src[1];      /* list of sources */
    };
    struct { /* (SDES) */
      u_int32 src; /* first SSRC/CSRC */
      rtcp_sdes_item_t item[1]; /*list of SDES*/
    };
};
};
```


[4] RTCP

u_int32   32   ,
SR(Sender Report)
                , timestamps
, RR(Receiver Report)   loss,   ,
                        . SDES(Source
Description)   ,
CNAME, e-mail   , Bye
                .

                .

Step 1) UAS   UAC   INVITE   .
Step 2) UAC   UAS   RESPONSE   .
Step 3) UAS   UAC   ACK   .
Step 4) UI(User Interface)
                            Wave   .
Step 5)   Wave   RTP
    .

Step 6)   RTP   UDP   UAC
                .
Step 7) UAS   UAC   BYE   .
Step 8) UAC   UAS   RESPONSE   .
Step 9) UAS   UAC   ACK   .

4.

4.1

                        Windows
                                        .
        ,
                ,   SIP
.   H.323
                                            SIP
                H.323   RTP   RTT
                                    .   SIP
                                            H.323

, Via

                                    . RTCP

        ,   loss   ,
                                    .
VoIP system   SIP
        .

4.2

                    LAN
                                    Drop
        ,
                        .
                                        ,
                                    ,
                            .

5.

[1] H. Schulzrinne et al., "RTP : A Transport Protocol for Real-Time Applications," Internet Standard, RFC 1889
[2] Rosenberg et al., "Timer reconsideration for enhanced RTP scalability," IEEE INFOCOM, 1998
[3] El-Marakby, R.; Hutchison, D., " Delivery of real-time continuous media over the Internet," Computer and Communications, 1997
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[5] Hong Liu, Voice over IP Signaling: H.323 and Beyond, IEEE Communications Mag., Oct. 2000.
[6] G.A Thom, "H.323:The Multimedia Communications Standard for Local Area Networks," IEEE Comm. Mag.,Dec 1996.
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