

## MAYAH Communications Application Note 33

# Automatic Jitter Compensation

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## 1. General description

IP networks are packet-orientated networks. These networks are not synchronized by clocks, so it's normal behavior that receive time of datagrams varies depending on network environment and network traffic. To avoid audio noise on such networks it's possible to configure encoder and/or decoder in a certain way described below to reach the highest reliability and ease-of-use. MAYAH has developed a standards-based Automatic Jitter Compensation technology.

This AJC feature provides an automatic adaptation of the RTP/IP transmission to network capabilities when using the interfaces Ethernet, 3G or WLAN. The AJC optimizes the following parameters at:

- **Encoder side:** The information provided by the peer via RTCP/IP is used for evaluation of the network capabilities. If applicable the packet size is increased first, to improve the transmission (a bigger packet size results in less RTP/IP overhead). If increasing packet size does not lead to satisfactory results then the encoder bit rate will be reduced automatically.
- **Decoder side:** If necessary the audio delay is increased to adapt the transmission to a current network conditions. Increasing the audio delay is achieved by increasing the receive buffer for incoming RTP/IP packets.

The parameters mode and time can be set independently for encoder and decoder.

## 2. Technical description

AJC is only available on RTP/IP and RTCP/IP controlled audio connections and compatible to all kinds of decoder devices which fully supports RTCP/IP receiver reports.

### RTCP/IP header:

```

0          1          2          3
0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-----+-----+-----+-----+-----+-----+-----+-----+-----+
|V=2|P|   RC   |   PT=RR=201   |           length           | header
+-----+-----+-----+-----+-----+-----+-----+-----+
|
|           SSRC of packet sender           |
+=====+=====+=====+=====+=====+=====+=====+=====+
|           SSRC_1 (SSRC of first source)   | report
+-----+-----+-----+-----+-----+-----+-----+-----+
| fraction lost | cumulative number of packets lost | 1
+-----+-----+-----+-----+-----+-----+-----+-----+
|           extended highest sequence number received           |
+-----+-----+-----+-----+-----+-----+-----+-----+
|           interarrival jitter           |
+-----+-----+-----+-----+-----+-----+-----+-----+
|           last SR (LSR)           |
+-----+-----+-----+-----+-----+-----+-----+-----+
|           delay since last SR (DLSR)           |
+=====+=====+=====+=====+=====+=====+=====+=====+
|           SSRC_2 (SSRC of second source)   | report
+-----+-----+-----+-----+-----+-----+-----+-----+
:           ...           : 2
+=====+=====+=====+=====+=====+=====+=====+=====+
|           profile-specific extensions           |
+-----+-----+-----+-----+-----+-----+-----+-----+

```

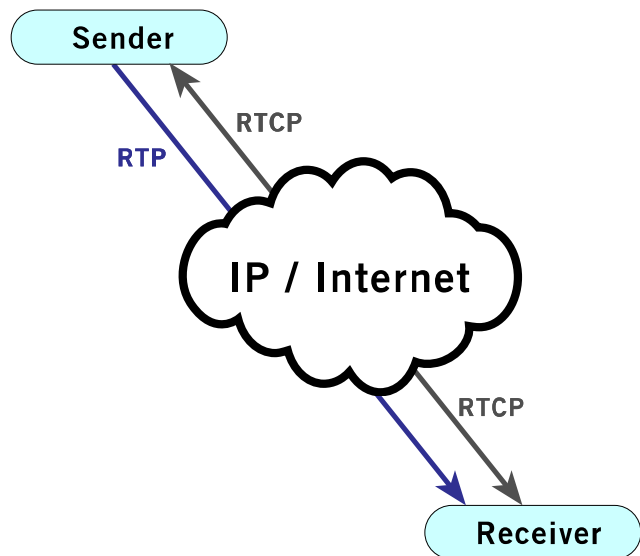
## 2.1 Network States

The following information is used to build the network states:

- LOP actual lost packet count
- Y last lost packet count
- JITTERactual jitter value
- X last jitter value

Jitter estimation:

- $S_i$  - RTP timestamp RTP of packet  $i$
- $R_i$  - reception instant of packet  $i$
- $D_i$  - jitter estimation for packet  $i$   
 $D_i = (R_i - R_{i-1}) - (S_i - S_{i-1})$
- $J_i$  - temporal average of the jitter for packet  $i$   
 $J_i = 15/16 J_{i-1} + 1/16 |D_i|$



Following information is provided by the receiver over RTCP/IP.

### 2.1.1 Unknown

If no RTCP/IP packets are received the network state is unknown.

### 2.1.2 Good

The network state is good if JITTER is not increasing and LOP doesn't occur ( $JITTER < X$ ;  $LOP < Y$ ).

### 2.1.3 Jitter

The network state is jitter if the JITTER is increasing and LOP doesn't occur ( $JITTER > X$ ;  $LOP < Y$ ).

### 2.1.4 Packet lost

The network state is packet lost if the lost of IP datagrams is increasing during a transmission ( $LOP > Y$ ).

## 2.2 Encoder

Encoder analyzes RTCP datagrams of the decoder to configure its outgoing data stream for an optimized transmission. This time for optimization could be configured by the user. During this time it's possible that the encoder reduce the streaming bandwidth by increasing the IP packet size or reducing the bit rate or sample rate. Audio is still available during the optimization phase.

## 2.3 Decoder

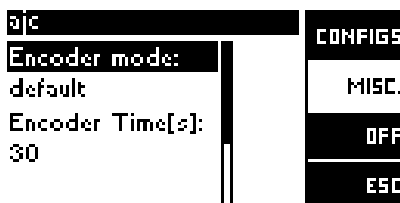
Decoder analyzes the receiving time of the encoder stream. The period of time used for the analysis can be configured by the user. During this time the decoder will recognize the highest jitter time and use this time as an expected maximum audio delay time.

# 3. How to use on MAYAH devices

## 3.1 via Front panel

Please step to the menu SYSTEM | MISC. | AJC to set up the corresponding parameters.

### 3.1.1 Encoder



#### 3.1.1.1 Mode

AJC can be set on encoder to

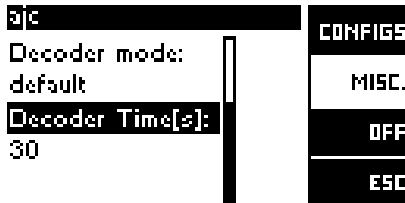
- auto AJC is enabled
- off AJC is disabled
- default AJC is reset to factory default

Default is auto with 30 seconds.

### 3.1.1.2 Time

Encoder evaluation time can be set independently.  
The default is 30 seconds.

## 3.1.2 Decoder



### 3.1.2.1 Mode

AJC can be set on decoder to

- auto AJC is enabled
- off AJC is disabled
- default AJC is reset to factory default

Default is auto with 30 seconds.

### 3.1.2.2 Time

Decoder evaluation time can be set independently.  
The default is 30 seconds.

## 3.2 with Direct Commands

Please refer to the Communication Reference Manual for further detailed informations.

### 3.2.1 Encoder

#### 3.2.1.1 *com\_ajc\_encmode*

AJC can be set on encoder to

- auto AJC is enabled
- off AJC is disabled
- default AJC is reset to factory default

Default is auto with 30 seconds.

#### 3.2.1.2 *com\_ajc\_enctime*

Encoder evaluation time can be set independently.  
The default is 30 seconds.

## **3.2.2 Decoder**

### **3.2.2.1 *com\_ajc\_decmode***

AJC can be set on decoder to

- auto AJC is enabled
- off AJC is disabled
- default AJC is reset to factory default

Default is auto with 30 seconds.

### **3.2.2.2 *com\_ajc\_dectime***

Decoder evaluation time can be set independently.

The default is 30 seconds.