# Panasonic
## BUSINESS

# Features of the HD Visual Communications System -- Developed with Cutting-Edge Panasonic Technologies

## ■ High Image Quality Gained by Many Years of Accumulating Image Processing Technologies

Some conventional videoconferencing systems display low-quality SD images. As a result, it is difficult to clearly see the facial expressions of people, characters on a whiteboard and details of a product displayed on the screen. This makes them unsuitable for use in detailed discussions.

The HD Visual Communications System displays full-HD images, and uses the H.264 high-profile codec for high image compression efficiency. By maximising the original image quality technologies that Panasonic developed and refined for use in VIERA TVs and DIGA recorders, the HD Visual Communications System achieves clear, life-like images that clearly show the facial expressions of people in distant locations as if they were in the same room.

## ■ Original Echo Canceller Technology for High Sound Quality

The sound quality of some videoconferencing systems is poor, so it is difficult to understand what people at remote sites are saying. In addition, the sound is sometimes interrupted. This requires the speaker to repeat whatever he or she said. As a result, long meetings can often cause stress in participants.

The conventional echo canceller system is designed to cut off all voices captured by the microphone on the other side of the communication in order to prevent echoing. Therefore, if people on both sides start talking at the same time, the conventional echo canceller system also cuts off the voice at the local site, making it impossible to hold smooth two-way conversations. In the development of the HD Visual Communications System, Panasonic aimed to create a system that would enable natural two-way conversations.

The HD Visual Communications System uses an independent component analysis (ICA) system to separate echoes from the voices of speakers at the local site. This system separates the echo and the speaker's voice with high accuracy, to make a significant improvement in echo canceller performance. A stationary-noise suppression function also reduces stationary noise, such as that from an air conditioner or a projector, to enable smooth, stress-free conferences.

### Conventional System (Voice Switching)
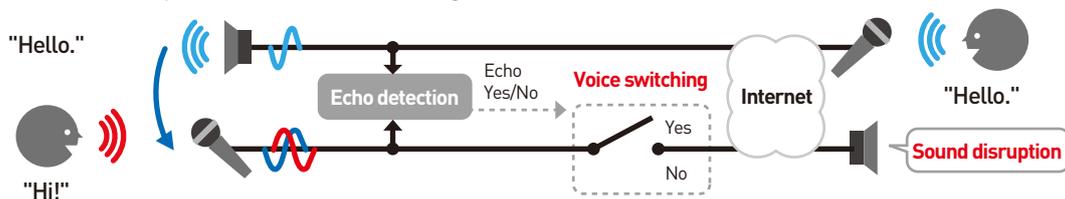


### New system (ICA echo canceller)

Sound from the speaker picked up by the microphone is reproduced through simulation and removed from the microphone signal.
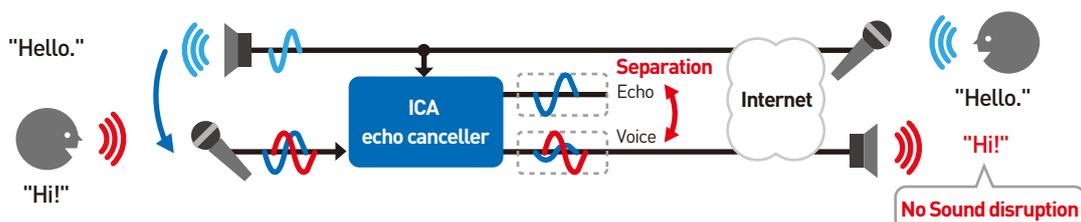
The special microphone also has four microphone elements. These four elements detect the direction of the microphone and capture 360° stereophonic sound through the right and left channels. Therefore, it can capture the speaker's voice regardless of the direction of the voice. This enables flexible positioning of the microphone, since the microphone picks up the speaker's voice from any direction and ensures that the reproduced sound matches the image on display, thus allowing comfortable, natural conversations.

## ■ AV-QoS Technology for a Stable Connection

Most conventional videoconferencing systems were developed based on connecting through an intranet.

In many cases of in-house use, the video streaming bandwidth is set low, and this prevents the display of images with the best possible quality. Conventional systems are used mostly for interoffice communications, and they are seldom used for communication with people at remote locations. Indeed, ISDN, which is expensive and has a narrow bandwidth, is still used quite commonly.

As Internet services have spread, a variety of services that are economical and easy to use, such as Internet VPN, are now available. A VPN that uses the Internet as an access line enables low-cost videoconferencing.

Panasonic aimed to achieve visual communications with high-quality images and sound by maintaining a stable connection over the Internet.

Most VPN services are a best-effort type with no guarantee of bandwidth, and the actual bandwidth fluctuates depending on the network conditions. When the number of users or the frequency of use increases, the bandwidth available to each user for communication use decreases, thus requiring a longer time to send data.

To use video and sound streams for videoconferencing between two distant locations, it is necessary to transmit video and sound signals without generating any disturbance to the voice or images being transmitted even when the usable bandwidth decreases.

Furthermore, since packet losses that may occur during transmission cause interruptions in the sound or image display, it is desirable to prevent packet loss by ensuring high-precision tracking even when the usable bandwidth fluctuates.

To enable interactive conversations, low-delay transmission is also essential.

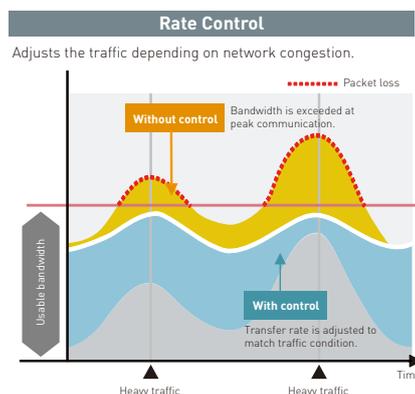In other words, AV-QoS technology providing the following three functions is required.

1) Technology that does not cause interruptions or disturbances in the sound or image due to packet losses even when the network is congested

2) Technology that prevents interruptions or disturbances in the sound or image even if a packet loss occurs

3) Technology that minimises the reproduction hold time required for absorbing jitter generated during transmission over a network

Panasonic's original AV-QoS technology achieves smooth visual communications without image or sound interruptions even when the bandwidth fluctuates or packet losses occur frequently in an Internet connection without guaranteed bandwidth.

### 1. Technology that does not cause interruptions or disturbances in the sound or image due to packet losses even when the network is congested

#### Rate Control Function

Since the usable bandwidth in an Internet connection changes due to increases or decreases in data traffic, the streaming flow rate must be adjusted in accordance with the changing usable bandwidth. The Rate Control function of the HD Visual Communications System controls the encoding rate according to the usable bandwidth in the network in order to minimise interruptions and disturbances in the sound and image caused by packet losses.



**Rate Control**

Adjusts the traffic depending on network congestion.

········· Packet loss

**Without control** — Bandwidth is exceeded at peak communication.

Usable bandwidth

**With control** — Transfer rate is adjusted to match traffic condition.

Heavy traffic    Heavy traffic    Time

## 2. Technology that prevents interruptions or disturbances in the sound or image even if a packet loss occurs

### FEC/ARQ

To prevent interruptions in the sound and image through an Internet connection, it is necessary to recover as much data as possible from packet losses. The FEC (Forward Error Correction) and ARQ (Automatic Repeat reQuest) technologies are commonly used to recover data from packet losses.

FEC adds minimum redundant data in advance to the data sent from the transmitting side so that the receiving side can detect and correct errors in received data by using the added redundant data. When the receiving side detects an error, it corrects the error by using a normal packet that has been received.

ARQ is a type of error correction system in which the data receiving side automatically requests retransmission of a packet when a packet loss occurs in communication. Since ARQ uses the bandwidth only to retransmit packets, it achieves efficient bandwidth use. However, because the decoder cannot reproduce the stream until the missing packet is received, it results in a longer end-to-end delay time that disturbs interactive communication.

In view of these, Panasonic adopted a hybrid FEC/ARQ system. When a packet loss occurs, this system selects the most suitable system according to the condition of the communication line, and minimises the image and sound disturbance and the end-to-end delay time.

## 3. Technology that minimises the reproduction hold time required for absorbing jitter generated during transmission over a network

### Delay Control

For smooth interactive communication using an Internet-connected videoconferencing system, data must be transmitted with the lowest possible delay. Panasonic developed the following two functions in order to achieve reliable communication with time restrictions in which the receiver terminal dynamically changes the delay time for retransmission as necessary.

● **Absorption of Fluctuations in Transmission Delay Time**
Internet congestion prolongs the transmission delay time. This is observed as a fluctuation (jitter) of the transmission delay time at the receiver terminal. When jitter occurs, the supply of data to the decoder is delayed, resulting in a shortage of data, thus causing a sound interruption or jerky image. To prevent this, it is necessary to monitor jitter and delay the reproduction according to the amount of jitter.

● **Securing Retransmission Opportunities**
For ARQ to function effectively, the reproduction time must be delayed according to the RTT when a packet loss occurs in order to increase retransmission opportunities. When the frequency of packet loss generation decreases, the reproduction time can be brought forward for low-delay transmission.

The HD Visual Communications System uses adaptive delay control to minimise jitter and the reproduction time delay caused by ARQ, thus offering stable and comfortable communication.

## Tomorrow's Visual Communications Today

The HD Visual Communications System relieves users from the stress caused by low image quality, poor sound quality and communication interruptions, to deliver smooth visual communication.

With the HD Visual Communications System, you can talk with people in distant locations as if you were all in the same room.

For the manufacturing industry, development staff and members of the sales department working in different locations can discuss products while viewing close-up, highly detailed product images.

In the field of medicine, university hospitals in large cities can provide specialised medical advice to local hospitals. And in the field of education, university laboratories can interconnect their HD Visual Communications Systems to conduct joint research and also to provide lectures at faraway locations.

In virtually all kinds of businesses, the HD Visual Communications System can achieve effective communication that conventional videoconferencing systems simply could not. As such, it promises to bring major changes to future work styles.