

# InterwiseConnect™

## Bandwidth Considerations

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## Introduction

Often potential customers ask Interwise for the required bandwidth for live communications within Interwise Connect. The answer to that question is subject to many parameters and configuration options (such as the live video configuration). However, this document attempts to set the scope of the parameters that affect the bandwidth.

Interwise Connect incorporates many built-in mechanisms for limiting and reducing the consumed bandwidth. It is recommended to consult with an Interwise technical expert about the different possibilities that best matches your network.

## Determining Bandwidth Resources

The bandwidth needed for a Communications Server can be calculated by multiplying the voice, video and data bandwidth with the number of child servers (PXs and ITs) and Participant applications.

The video stream is configurable in the end users station.

The voice stream is dependent on the Event type (a Moderated Event requires 2 KBPS where iMeeting requires ~3.5KBPS). Another factor that influences the required bandwidth is the use of Multicast as demonstrated below.

### Without Multicast

$$\text{Bandwidth(KBPS)} = (\text{Servers} + \text{Participants}) * (2 + X * V + Y * AS)$$

Where:

- ◆ 0.3 KBPS is the basic requirement for Event data stream
- ◆ 2 KBPS is the basic requirement for audio + slides, etc.
- ◆ X is the video bandwidth, can be anywhere between 8 and 128 KBPS.
- ◆ Y is the application sharing bandwidth - typically 1 to 3 KBPS.
- ◆ The values of V and AS are boolean, 0 or 1 depending on the scenario.

### With Multicast



**Note:** This assumes that all Participants have successfully joined the application sharing at roughly the same time.

$$\text{Bandwidth (KBPS)} = \text{Servers} * (2 + X * V) + (0.3 * \text{Participant ts} + 1.7 + X * V) + (\text{Servers} + \text{Participant ts}) * Y * AS$$

Where:

- ◆ 2 KBPS is the basic requirement for audio + slides, etc.
- ◆ X is the video bandwidth, can be anywhere between 8 and 128 KBPS.
- ◆ Y is the application sharing bandwidth - typically 1 to 3.
- ◆ The values of V and AS are boolean, 0 or 1 depending on the scenario.



### Notes:

1. Each Server receives regular audio and video streams.
2. Participants receive only 1 audio (1.7 KBPS) and 1 video (X) stream.
3. Application sharing data is not multicasted.



**Tip:** The Interwise Connect Site Tree architecture requires **ONLY ONE** stream between locations on the WAN, regardless of the number of Participants at each location.

### **Voice Bandwidth Requirements**

Participants are full duplex if their sound card supports full duplex (practically all sound cards today support full duplex).

When two Participants are speaking together, the bandwidth increases by 2 KBPS for the duration of the conversation.

Interwise Connect's unique voice melding feature lets all other Participants hear them naturally as two persons speaking simultaneously, and not as two separate intermittent streams.

### **Bandwidth Requirements for a Live Event**

The basic required bandwidth is 2.3 KBPS between a Participant and the Participant's Site. This includes the following bandwidth requirements:

- ◆ The basic configuration requires 2 KBPS for the audio stream and 0.3 KBPS for the data stream. This assumes that the audio channel is always open. Since Interwise Connect applications do not send 'silence', the actual requirements will be less than this.
- ◆ If the Presenter shares an application, 1 KBPS should be added to the basic figure, resulting in a total of 3 KBPS between a Participant and the Participant's Site.
- ◆ If the Participant uses live video in the Event, the application's basic 2.3 KBPS will be supplemented by the video bandwidth, which is in the range of 8 KBPS and 128 KBPS (this is defined by the user and based on the video camera device).

### **Example**

- ◆ A Presenter is located at Site A.
- ◆ 100 Participants are located at each of three locations on the company WAN.
- ◆ Each of the locations support Multicast (Ethernet always supports Multicast).
- ◆ The video is set to 16 KBPS.

### **Voice Only**

2.3 KBPS on each of the 3 WAN lines between Site A and the three locations. 32.3 KBPS on the LAN at each of the three remote locations.

### **Voice and Live Video**

18.3 KBPS on each of the three WAN lines between Site A and the three locations.  
48.3 KBPS on the LAN at each of the three remote locations.

### **Drops in Bandwidth**

Fluctuations in bandwidth in the network may at times effect video packets, audio packets and slides that are being sent. The extent of the impact depends on the communications protocol and the actual conditions when the fluctuations occur.

### **Video Packets**

Video packets are only queued for about 4 seconds. If they take longer to send, newer packets captured from the camera overrun them. Since audio packets have priority, video packets are only sent when the line is free and no audio is waiting in the queues. Consequently, when bandwidth falls, the video packets are dropped almost immediately.

### **Audio Packets**

The audio packets are queued for up to 20 seconds. They are sent at high priority with one retry attempt when needed.

Audio packets will be dropped after 20 seconds if bandwidth drops to zero - or longer depending on the bandwidth value. The application needs 1.6 KB for an audio stream. However, in actual practice less is needed because Interwise Connect applications do not send any audio packets if there is no voice activation.

### **Slides Data**

If no packet gets through for 60 seconds, a watchdog timer is triggered, and the application disconnects (the line is dead) and reconnects. Consequently, TCP socket timeouts never occur in practice. For more details, refer to the *Heartbeat Signal* section on the following page.

### **Actual Bandwidth**

In practice, the bandwidth jitters. It fluctuates between zero and its maximum.

- ◆ For network cutoffs up to 4 seconds, the Participant loses nothing (but ‘gains’ a delay of the same duration).
- ◆ Between 4-20 seconds, the Participant loses the video but not audio (which is further delayed).
- ◆ Between 20-30 seconds, the Participant loses older audio packets.
- ◆ Above 30 seconds, the application disconnects.

This is true only for total network cutoff. Usually, the protocol behaves much better since bandwidth drops but usually never to zero.

### **Firewall Effect on Bandwidth**

The most common scenario for working with Participants behind firewalls is to configure them to work in a TCP Only or Tunneling mode. The Communications Server feeding the Participant behind the firewall will automatically wrap the data stream with the appropriate protocol elements to accommodate the security requirements as defined by the Participant’s firewall. Any Communications Server in the Site Tree can transparently support this.

Using TCP Only or Tunneling increases bandwidth overheads by about 0.25 KBPS, and the inherent characteristic TCP of behavior causes somewhat longer delays.



**Note:** TCP requires a confirmation on each packet sent and resends packets until it succeeds. This adds to the amount of data sent.

Field experience shows that this increase is of no practical significance with decent connections.

### ***Heartbeat Signal***

Interwise Connect applications monitor their connection status by sending ‘Heartbeat’ signals (small packets) every 2 seconds when no other data is sent. If an application does not receive any packet for 30 seconds, the line is dead. You can reinitialize such an application by disconnecting and reconnecting.

Every Interwise Connect application sends a ‘Heartbeat’ signal of 60 bytes (36 of IP/UDP and 24 of Ethernet) to neighboring applications every 2 seconds if no other successful communication takes place.