

Display of Data Volume for the virtual team room

1 Data volume in the virtual team room

The data volume of a **vitero** session consists of two values: The amount of data which incurs while starting the software and entering the virtual team room and the amount of data that incurs during the session. The data volume depends especially on the use of VoIP, application sharing and/or webcam.

1.1 Data volume previous to the session

Data incurring while starting the session can be divided in a fixed and a variable value. The fixed value merely amounts to approximately 500 kByte and consists of data which incurs during the start of the communication between client and server. Files uploaded to the VMS, which are preloaded by the preload function, have to be added. On average this is about 40 kByte per PowerPoint slide. If participants have uploaded pictures for their avatars, additional 15 kByte per picture can be added. Therefore, for a session of 12 participants with pictures for their avatars and 30 PowerPoint slides, there are around 2 Mbyte of data transferred while entering the virtual team room.

1.2 Data volume within the session

Within the session, data are continuously exchanged between clients and servers. Depending on the usage this can be live audio (VoIP) and live video (webcam) data or desktop content transmitted by application sharing.

The transmission of data requires a certain minimum bandwidth to provide a smooth performance. Nevertheless, the actual required bandwidth strongly depends on the usage of the **vitero** software. If available, the client uses more bandwidth to provide better quality.

Listed below are several measured values¹. By means of these data different application scenarios are exposed. The required amount of bandwidth depends on the particular scenario (Is there audio transmitted per VoIP or per telephone? Is there a webcam in use? Are there videos transmitted by application sharing or is there only a Word document being worked on?).

	Minimum required bandwidth providing sufficient quality and stability		Maximum used bandwidth, if available	
	Upload in kByte	Download in kByte	Upload in kByte	Download in kByte
Without use of VoIP, webcam and application sharing	2,3	1,2	4,5	14
One speaker (measured at the sender)	5,7	5,7	11,1	21,3
One speaker (measured at the recipient)	1,5	7,3	4,5	19
One avatar webcam picture (100 x 124 pixel), no speaker (measured at the sender)	7,3	9,0	8,3	16,1
One avatar webcam picture (100 x 124 pixel), one speaker (measured at the sender)	11,5	8,0	13,6	32,2
One table webcam picture (500 x 370 pixel; little movement), no speaker (measured at the sender)	20,2	6,2	31,6	9,7

¹ Data have been measured using Wireshark Version 1.4.6 and Windows 7 Professional 64 Bit and **vitero** version 5.x. SSL encryption of data transmission to Flash Media Server, direct connection without proxy server

	Minimum required bandwidth providing sufficient quality and stability		Maximum used bandwidth, if available	
	Upload in kByte	Download in kByte	Upload in kByte	Download in kByte
Application sharing (890 x 670 pixel) editing a Word document (measured at the sender)	4,3	0,7	6,9	1,0
Application sharing (890 x 670 pixel) video transmission (measured at the sender)	31,8	1,5	74,8	4
Application sharing (890 x 670 pixel) PowerPoint presentation with breaks (measurement at the sender)	15,8	1,1	34,0	2,2
Video playback (480 x 270 pixel)	-	-	12,8	63,6
Video playback (640 x 360 pixel)	-	-	12,8	68,2
Video playback (1280 x 720 pixel)	-	-	13,3	143,8

Sample calculations can be made for different scenarios on basis of these values. Nevertheless, these calculations can only show a tendency. In the end, the data volume of a session depends on the tools that are used and how they are used.

2 Data volume regarding various scenarios

2.1 Requirements

The examples are based on a one-hour-session with 13 persons (12 participants plus moderator) and 30 PowerPoint slides. On average one slide comprises 40 kByte. The data basis for calculating the data volume of a session consists of average values.

2.2 Audio per telephone, slides, no webcam, no application sharing

In this scenario audio communication takes place by telephone. Application sharing and webcam are not used and content is displayed by the slide projector.

Until the start of the session approximately 2 MByte data are transmitted:
 $500 \text{ kByte} + 13 \text{ participants} * 15 \text{ kByte (avatar pictures)} + 30 * 40 \text{ kByte (slides)} = 1895 \text{ kByte}$

During the session the client requires bandwidth between 4 kByte/s and 19 kByte/s to synchronize. With an average value of 12 kByte/s it is assumed that an overall data volume of approximately 45 MByte is required for one hour.

2.3 Audio per VoIP, slides, no webcam, no application sharing

In this scenario audio communication takes place by **vitero** VoIP. Application sharing and webcam are not used and content is displayed by the slide projector.

Until the start of the session approximately 2 MByte data are transmitted:
 $500 \text{ kByte} + 13 \text{ participants} * 15 \text{ kByte (avatar pictures)} + 30 * 40 \text{ kByte (slides)} = 1895 \text{ kByte}$

During the session the client requires bandwidth between 12 kByte/s and 32 kByte/s for audio and synchronization. With an average value of 22 kByte/s it is assumed that an overall data volume of approximately 90 MByte is required for one hour.

2.4 Audio per VoIP, no slides, no webcam, application sharing

In this scenario audio communication takes place by **vitero** VoIP. Slide projector and webcam are not used and content is displayed by application sharing.

Until the start of the session approximately 1 MByte data are transmitted:

$500 \text{ kByte} + 13 \text{ participants} * 15 \text{ kByte (avatar pictures)} = 695 \text{ kByte}$

During the session the client requires bandwidth between 12 kByte/s and 32 kByte/s for audio and synchronization. With an average of 22 kByte/s it is assumed that an overall data volume of approximately 90 MByte is required for one hour.

For application sharing an average of 30 kByte/s is assumed. This corresponds to a usage which comprises changes to pictures and breaks, as they are common when using PowerPoint. For one hour this adds up to approximately 105 MByte.

Altogether, a session of this kind requires approximately 195 MByte data volume per hour and participant.

2.5 Audio per VoIP, no slides, one avatar webcam, application sharing

In this scenario audio communication takes place by **vitero** VoIP. The slide projector is not used, content is displayed by application sharing and the moderator uses a webcam.

Until the start of the session approximately 1 MByte data are transmitted:

$500 \text{ kByte} + 13 \text{ participants} * 15 \text{ kByte (avatar pictures)} = 695 \text{ kByte}$

During the session the client requires bandwidth between 20 kByte/s and 46 kByte/s for audio, video and synchronization. With an average of 33 kByte/s it is assumed that an overall data volume of approximately 120 MByte is required for one hour.

With application sharing an average of 30 kByte/s is assumed. This corresponds to a usage which comprises changes to pictures and breaks, as they are common when using PowerPoint. For one hour this adds up to circa 105 MByte.

Altogether, a session of this kind requires approximately 255 MByte data volume per hour and participant.

2.6 Audio per VoIP, no slides, one table webcam, no application sharing

In this scenario audio communication takes place by **vitero** VoIP. The slide projector and application sharing are not used. The moderator uses the webcam to transmit a live picture on the table.

Until the start of the session approximately 1 MByte data are transmitted:

500 kByte + 13 participants * 15 kByte (avatar pictures) = 695 kByte

During the session the client requires bandwidth between 38 kByte/s and 60 kByte/s for audio, video and synchronization. With an average of 50 kByte/s it is assumed that an overall data volume of approximately 175 MByte is required for one hour.