

# Storage requirements

This article helps disk size dimensioning. Required storage size depends upon the **number and length of calls** and the **applied codec**.

- [Estimate your storage requirements](#)
- [Voice](#)
  - [Supported voice codecs for recording](#)
  - [Voice codecs for storage and playback](#)
  - [Stereo voice recording](#)
  - [Silence Suppression for voice recording \(Voice Activity Detection, VAD\)](#)
    - [Enabling the silence suppression \(VAD\) on the recorder service side](#)
    - [Selecting a storage codec which supports silence suppression](#)
- [Video](#)
  - [Supported video codecs for recording](#)
  - [Video codecs for storage and playback](#)
- [Screen](#)
  - [Screen codecs for storage and playback](#)

## Estimate your storage requirements

You can **download the Excel Verba Storage Calculator Sheet** to estimate your storage requirements for **IM, voice, video, telepresence and screen recording** applications. It also provides you information on **database** storage sizing.

The calculator sheet includes **Excel macros**, which might be disabled when the file is downloaded from the site. Please **Enable Editing** and **Enable Content** (to turn on macros) when Excel is asking for it, otherwise the calculator will not work.

## Voice

### Supported voice codecs for recording

The system supports recording of the following voice codecs:

| Codec name                             | Sample rates       |
|--|--------------------|
| G.711 A-law, G.711 -law                | 8Khz               |
| G.723                                  | 8Khz               |
| G.726-16, G.726-24, G.726-32, G.726-40 | 8Khz               |
| G.728                                  | 8Khz               |
| G.729, G.729A, G.729B, G.729AB         | 8Khz               |
| GSM                                    | 8Khz               |
| iLBC                                   | 8Khz               |
| RED                                    | 8Khz               |
| G.722                                  | 16Khz              |
| SILK                                   | 8Khz, 16Khz        |
| Microsoft RTAudio (X-MSRTA)            | 8Khz, 16Khz        |
| G.722.1                                | 16Khz, 32Khz       |
| Siren7, Siren14                        | 16Khz, 32Khz       |
| Speex                                  | 8Khz, 16Khz, 32Khz |

|                             |                           |
|-----------------------------|---------------------------|
| Opus                        | 8Khz, 16Khz, 48Khz        |
| CELT                        | 8Khz, 16Khz, 32Khz, 48Khz |
| L8 (PCM8)                   | 8Khz, 16Khz, 32Khz, 48Khz |
| L16 (PCM16, Cisco Wideband) | 8Khz, 16Khz, 32Khz, 48Khz |
| MP4A-LATM                   | 48Khz                     |
| MPEG4-generic               | 48Khz                     |
| AAC-LD                      | 48Khz                     |

## Voice codecs for storage and playback

The Verba system is able to store audio files in many file formats with different codecs. The sample rate of the output file depends on the sample rate of the input codec (see above).

Supported formats:

| Codec for storing media     | File format | Sample rate | Bandwidth        | 1-minute file size | 1-hour file size |
|-----------------------------|-------------|-------------|------------------|--------------------|------------------|
| PCM16                       | wav         | <b>8Khz</b> | <b>128 Kbps</b>  | <b>960 KB</b>      | <b>56.3 MB</b>   |
|                             |             | 16Khz       | 256 Kbps         | 1.9 MB             | 112.5 MB         |
|                             |             | 32Khz       | 512 Kbps         | 3.8 MB             | 225 MB           |
|                             |             | 48Khz       | 768 Kbps         | 5.6 MB             | 337.5 MB         |
| PCM8                        | wav         | <b>8Khz</b> | <b>64 Kbps</b>   | <b>480 KB</b>      | <b>28.1 MB</b>   |
|                             |             | 16Khz       | 128 Kbps         | 960 KB             | 56.3 MB          |
|                             |             | 32Khz       | 256 Kbps         | 1.9 MB             | 112.5 MB         |
|                             |             | 48Khz       | 384 Kbps         | 2.8 MB             | 168.8 MB         |
| G.711<br>(both A and )      | wav         | <b>8Khz</b> | <b>64 Kbps</b>   | <b>480 KB</b>      | <b>28.1 MB</b>   |
|                             |             | 16Khz       | 128 Kbps         | 960 KB             | 56.3 MB          |
|                             |             | 32Khz       | 256 Kbps         | 1.9 MB             | 112.5 MB         |
|                             |             | 48Khz       | 384 Kbps         | 2.8 MB             | 168.8 MB         |
| MSADPCM                     | wav         | <b>8Khz</b> | <b>32 Kbps</b>   | <b>240 KB</b>      | <b>14.1 MB</b>   |
|                             |             | 16Khz       | 64 Kbps          | 480 KB             | 28.1 MB          |
|                             |             | 32Khz       | 128 Kbps         | 960 KB             | 56.3 MB          |
|                             |             | 48Khz       | 192 Kbps         | 1.4 MB             | 84.4 MB          |
| <b>GSM FR<br/>Most used</b> | <b>wav</b>  | <b>8Khz</b> | <b>13,2 Kbps</b> | <b>99 KB</b>       | <b>5.8 MB</b>    |
| Speex                       | ogg         | <b>8Khz</b> | <b>6 Kbps</b>    | <b>45 KB</b>       | <b>2.6 MB</b>    |
|                             |             | 16Khz       | 16 Kbps          | 120 KB             | 7 MB             |
|                             |             | 32Khz       | 24 Kbps          | 180 KB             | 10.5 MB          |
| High Quality Speex          | ogg         | <b>8Khz</b> | <b>10 Kbps</b>   | <b>75 KB</b>       | <b>4.4 MB</b>    |
|                             |             | 16Khz       | 24 Kbps          | 180 KB             | 10.5 MB          |
|                             |             | 32Khz       | 32 Kbps          | 240 KB             | 14.1 MB          |
| Opus                        | ogg         | <b>8Khz</b> | <b>9 Kbps</b>    | <b>67.5 KB</b>     | <b>4 MB</b>      |
|                             |             | 16Khz       | 18 Kbps          | 135 KB             | 7.9 MB           |
|                             |             | 24Khz       | 24 Kbps          | 180 KB             | 10.5 MB          |
|                             |             | 48Khz       | 32 Kbps          | 240 KB             | 14.1 MB          |

| High Quality Opus | ogg | 8Khz  | 14 Kbps | 105 KB | 6.2 MB  |
|-------------------|-----|-------|---------|--------|---------|
|                   |     | 16Khz | 24 Kbps | 180 KB | 10.5 MB |
|                   |     | 24Khz | 32 Kbps | 240 KB | 14.1 MB |
|                   |     | 48Khz | 48 Kbps | 360 KB | 21.1 MB |

In addition to the audio codecs above, the system also supports other codecs for storing voice recordings in the system. These additional audio codecs and file formats are not supported by the recorders in the system, these files are usually imported into the platform from 3rd party / legacy systems.

- WAVE container
  - G.723.1 (Mono / Stereo)
  - G.729 (Mono / Stereo)
  - G.722 (Mono / Stereo)
  - G.726 (Mono / Stereo)
- MP3
- M4A
- VOX
- AU

## Stereo voice recording

With stereo recording, the caller and the callee are recorded into two separate channels; caller in the left channel and the callee in the right channel. This enables listening to the participants separately during the playback.

In the case of stereo recording mode, the recorded media file sizes have to be multiplied by two. There are two exceptions:

- GSM FR does not support stereo recording
- In the case of Speex codec, the multiplier is only 1.2X

## Silence Suppression for voice recording (Voice Activity Detection, VAD)

The size of the recorded media files can be reduced by enabling the silence suppression. This is achieved by not writing data to disk when there is only silence in the voice calls. In this case, the size of the recorded media will depend on how much silence there is in the call, but the **average reduction in the file size is 25%**.

Silence suppression can be enabled in two ways:

### Enabling the silence suppression (VAD) on the recorder service side

Verba supports silence suppression in the recording service. This is not available in the case of Skype for Business or passive recording. The VAD settings can be found under the **Unified Call Recorder \ Media Recorder \ Media Splitting** node in the server configuration.

### Selecting a storage codec which supports silence suppression

There are several codecs which natively support silence suppression. This enables the size reduction of the recorded media files regardless of the recorded platform. The list of these codecs is the following:

- Speex with silence suppression
- High Quality Speex with silence suppression
- Opus with silence suppression
- High Quality Opus with silence suppression

## Video

### Supported video codecs for recording

The system supports the recording of the following video codecs:

- H.261
- H.263
- H.263+

- H.263++
- H.264
- H.264 SVC
- VP8

## Video codecs for storage and playback

The system records the video stream into a proprietary file format (Verba Media Format -VMF) which includes the raw audio and video network streams. When video recording is enabled for a user, the system only creates a single recording which includes both audio and video. The size of the VMF file depends on the original network streams captured during recording.

The system offers transcoding for the VMF files which can be configured as a data management policy or manually invoked from the Player /Viewer. In both cases, a target file format has to be selected from the available options. The system currently supports the following file formats, audio and video codecs, resolutions and bandwidth (which defines the quality of the video for the target resolution, it also defines the size of the output file):

- MPEG-4 (AAC + H.264), High Definition 1280x720 48KHz Stereo, 1564 kbit/sec
- Windows Media, Mobile Device 320x240 16KHz Stereo, 256 kbit/sec
- Windows Media, Mobile Device 320x240 16KHz Stereo, 384 kbit/sec
- Windows Media, Mobile Device 320x240 16KHz Stereo, 512 kbit/sec
- Windows Media, Internet 640x480 16KHz Stereo, 384 kbit/sec
- Windows Media, Internet 640x480 16KHz Stereo, 512 kbit/sec
- Windows Media, Internet 640x480 16KHz Stereo, 768 kbit/sec
- Windows Media, High Definition 1280x720 48KHz Stereo, 1024 kbit/sec
- Windows Media, High Definition 1280x720 48KHz Stereo, 1512 kbit/sec
- Windows Media, High Definition 1280x720 48KHz Stereo, 2096 kbit/sec
- Windows Media, Full High Definition 1920x1080 48KHz Stereo, 1512 kbit/sec
- Windows Media, Full High Definition 1920x1080 48KHz Stereo, 2096 kbit/sec
- Windows Media, Full High Definition 1920x1080 48KHz Stereo, 3192 kbit/sec
- MPEG-4 (AAC + H.264), Low Definition 176x144 16KHz Mono, 60 kbit/sec
- MPEG-4 (AAC + H.264), Low Definition 176x144 16KHz Mono, 80 kbit/sec
- MPEG-4 (AAC + H.264), Low Definition 176x144 16KHz Mono, 100 kbit/sec
- MPEG-4 (AAC + H.264), Standard Definition 480x360 48KHz Stereo, 448 kbit/sec
- MPEG-4 (AAC + H.264), Standard Definition 480x360 48KHz Stereo, 628 kbit/sec
- MPEG-4 (AAC + H.264), Standard Definition 480x360 48KHz Stereo, 896 kbit/sec
- MPEG-4 (AAC + H.264), High Definition 1280x720 48KHz Stereo, 2128 kbit/sec
- MPEG-4 (AAC + H.264), High Definition 1280x720 48KHz Stereo, 2692 kbit/sec

## Screen

### Screen codecs for storage and playback

The system stores screen recordings in a proprietary file format (Verba Media Format -VMF) which includes the desktop screen content in the selected format. The screen captures are automatically multiplexed with the corresponding voice recordings which result in new, updated VMF files which include the recorded audio streams and the screen capture.

All numbers below are given per minute, using 4 frames/ second recording. These shall be used as guidelines, they can not represent exact storage requirements. Storage requirements are strongly effected by screen capture rate (saved frames per second), screen resolution, color depth and amount of changes on the screen during recording.

| Compressing algorithm      |   | Average business app<br>Data entry forms<br>(few changes on screen) | Multiple applications (window<br>switching)<br>Application with window<br>scrolling (browser)<br>(many changes on screen) |
|----------------------------|---|---|---|
| Verba Screen Codec         | 1024x768 32bit color  | 0.1-0.3 Mbyte/min   | 0.5-1.5 Mbyte/min   |
| Verba Screen Codec         | 1280x1024 32bit color   | 0.2-0.6 Mbyte/min   | 0.8-5 Mbyte/min   |
| Windows Media Screen Codec | Constant bitrates are selectable between 768 kbps - 2 mbps (5-15 Mbyte/min) |   |   |

The system can record all resolutions, color depths, multiscreen setups, but the following recommendations help to dramatically lower disk space requirements of the recordings:

- Use the minimum possible screen resolution that still fulfills the usability requirements
- Use lower bit color depths

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- Turn off background picture on the desktop

The system offers transcoding for the VMF files which can be configured as a data management policy or manually invoked from the Player /Viewer. In both cases, a target file format has to be selected from the available options. The system currently supports the following file formats, video codecs, resolutions and bandwidth/quality:

- MPEG-4 (H.264), Medium Quality, 512 kbit/sec
- Windows Media, Low Quality, 512 kbit/sec
- Windows Media, Medium Quality, 1024 kbit/sec
- Windows Media, High Quality, 1512 kbit/sec
- Windows Media, Ultra High Quality, 2048 kbit/sec
- MPEG-4 (H.264), Low Quality, 384 kbit/sec
- MPEG-4 (H.264), High Quality, 768 kbit/sec
- MPEG-4 (H.264), Ultra High Quality, 1024 kbit/sec
- Verba Screen Format, Low Quality
- Verba Screen Format, Medium Quality
- Verba Screen Format, High Quality
- Verba Screen Format, Ultra High Quality