IP Device Integration Notes

Article ID: V1-15-01-20-t
Release Date: 01/20/2015

Applied to

GV-VMS V14.10

Summary

The document consists of three sections:

1. The total frame rate and the number of channels GV-VMS can support based on different CPU types, codec and resolutions
2. Workarounds to increase total frame rates supported by GV-VMS
3. The total frame rate supported by a single hard disk

Table of Contents

1. Total Frame Rate and Number of Channels Supported

The tables below show the total frame rates and number of channels GV-VMS can support with CPU usage under approximately 70% to ensure performance and stability. The test results vary according to the CPU types (Core i7, Core i5 and Core i3), the resolution and compression method (codec) set on the connected IP camera.

Also shown in the table is the number of full-frame channels GV-VMS can support. Note that the maximum number of frames per channel differs at different resolutions. Full-frame at 1.3 ~ 5 MP resolutions are defined as follows:

- 1.3 MP: 30 fps per channel
- 2 MP: 30 fps per channel
- 3 MP: 20 fps per channel
- 4 MP: 15 fps per channel
- 5 MP: 10 fps per channel

The following tables are available:

- Table 1: **Dual Streams** with CPU Decoding, 8 GB RAM (64 channels)
- Table 2: **Dual Streams** with CPU Decoding, 4 GB RAM (32 channels)
- Table 3: Single Stream with GPU Decoding, 8 GB RAM
- Table 4: Single Stream with GPU Decoding, 4 GB RAM
- Table 5: Single Stream with CPU Decoding, 4 GB / 8 GB RAM

[Single Stream vs Dual Streams]

When IP devices are set to **dual streams**, the total frame rate supported is increased because you can select lower resolution for live view and set the other stream to high quality video for recording. CPU usage is affected by live view decoding not recording.

[CPU Decoding vs GPU Decoding]

If your IP device does not support dual streams, refer to tables 3 to 5 for test results of single stream with CPU and GPU decoding. A higher total frame rate can be achieved if your CPU supports **GPU decoding**.

Note that GPU decoding only supports H.264 codec and that different chipsets have different resolution limitations:

- **Intel Sandy Bridge Chipsets** only support GPU decoding of 1.3 MP to 2 MP videos
- **Intel Ivy Bridge and Haswell Chipsets** support GPU decoding of 1.3 MP to 5 MP videos

[4 GB RAM vs 8 GB RAM]

When using GPU decoding, higher RAM can increase the total frame rate supported. Refer to tables 3 and 4 to see the GPU decoding test results for 4 GB RAM versus 8 GB RAM. When using CPU decoding and single stream, however, the total frame rate supported is usually limited by CPU loading, and not affected by RAM (see table 5).

Note: The test results below were obtained using a panel resolution of 1920 x 1080. The results may vary based on various factors, including actual environment and bitrates.

Table 1: Dual Streams with CPU Decoding (8 GB RAM, 64 channels)

CPU	Resolution	Codec	Total FPS Supported	Full-Frame Channels Supported	CPU Usage (%)	Virtual Memory Usage (MB)
Core i7 4770	1.3 MP (1280 x 1024)	H.264	1920	64 CH	36	3235
		MJPEG	1920	64 CH	57	3075
	2 MP (1920 x 1080)	H.264	1920	64 CH	50	3302
		MJPEG	1710	57 CH	73	2877
	3 MP (2048 x 1536)	H.264	1280	64 CH	38	3224
		MJPEG	1280	64 CH	61	3073
	5 MP (2560 x 1920)	H.264	640	64 CH	55	3295
		MJPEG	640	64 CH	52	3067
Core i5 4670	1.3 MP (1280 x 1024)	H.264	1920	64 CH	57	3325
		MJPEG	1590	53 CH	67	2768
	2 MP (1920 x 1080)	H.264	1920	64 CH	74	3304
		MJPEG	1260	42 CH	73	2445
	3 MP (2048 x 1536)	H.264	1280	64 CH	56	3243
		MJPEG	1040	52 CH	67	2746
	5 MP (2560 x 1920)	H.264	560	56 CH	73	3017
		MJPEG	570	57 CH	70	2856
Core i3 4130	1.3 MP (1280 x 1024)	H.264	1620	54 CH	73	2920
		MJPEG	1230	41 CH	71	2401
	2 MP (1920 x 1080)	H.264	1230	41 CH	72	2535
		MJPEG	960	32 CH	70	2153
	3 MP (2048 x 1536)	H.264	960	48 CH	69	2742
		MJPEG	780	39 CH	69	2360
	5 MP (2560 x 1920)	H.264	390	39 CH	72	2478
		MJPEG	430	43 CH	70	2471

Table 2: Dual Streams with CPU Decoding (4 GB RAM, 32 channels)

CPU	Resolution	Codec	Total FPS Supported	Full-Frame Channels Supported	CPU Usage (%)	Virtual Memory Usage (MB)
Core i7 4770	1.3 MP (1280 x 1024)	H.264	960	32 CH	12	2074
		MJPEG	960	32 CH	19	1910
	2 MP (1920 x 1080)	H.264	960	32 CH	21	2098
		MJPEG	960	32 CH	26	1944
	3 MP (2048 x 1536)	H.264	640	32 CH	14	2074
		MJPEG	640	32 CH	20	1996
	5 MP (2560 x 1920)	H.264	320	32 CH	37	2101
		MJPEG	320	32 CH	18	1914
Core i5 4670	1.3 MP (1280 x 1024)	H.264	960	32 CH	25	2054
		MJPEG	960	32 CH	38	1959
	2 MP (1920 x 1080)	H.264	960	32 CH	37	2078
		MJPEG	960	32 CH	47	1896
	3 MP (2048 x 1536)	H.264	640	32 CH	31	2064
		MJPEG	640	32 CH	36	1887
	5 MP (2560 x 1920)	H.264	320	32 CH	40	1990
		MJPEG	320	32 CH	34	1916
Core i3 4130	1.3 MP (1280 x 1024)	H.264	960	32 CH	41	2079
		MJPEG	930	32 CH	52	1917
	2 MP (1920 x 1080)	H.264	960	32 CH	52	2084
		MJPEG	600	32 CH	75	1906
	3 MP (2048 x 1536)	H.264	640	32 CH	43	2050
		MJPEG	640	32 CH	56	1906
	5 MP (2560 x 1920)	H.264	320	32 CH	61	2089
		MJPEG	320	32 CH	45	1893

Table 3: Single Stream with GPU Decoding (8 GB RAM)

CPU	Resolution	Codec	Total FPS Supported	Full-Frame CH Supported	CPU Usage (%)	Virtual Memory Usage (MB)
Core i7 4770	1.3 MP (1280 x 1024)	H.264	1350	45 CH	42	7003
	2 MP (1920 x 1080)		960	32 CH	18	6663
	3 MP (2048 x 1536)		660	33 CH	20	8414
	4 MP (2048 x 1944)		570	38 CH	27	10225
	5 MP (2560 x 1920)		410	41 CH	22	11865
Core i5 4670	1.3 MP (1280 x 1024)		1350	45 CH	71	6508
	2 MP (1920 x 1080)		960	32 CH	28	6331
	3 MP (2048 x 1536)		640	32 CH	33	7883
	4 MP (2048 x 1944)		555	37 CH	37	9581
	5 MP (2560 x 1920)		410	41 CH	43	11906
Core i3 4130	1.3 MP (1280 x 1024)		990	33 CH	72	5225
	2 MP (1920 x 1080)		930	31 CH	65	6172
	3 MP (2048 x 1536)		600	30 CH	56	7482
	4 MP (2048 x 1944)		540	36 CH	67	9387
	5 MP (2560 x 1920)		380	38 CH	63	10723

Table 4: Single Stream with GPU Decoding (4 GB RAM)

CPU	Resolution	Codec	Total FPS Supported	Full-Frame CH Supported	CPU Usage (%)	Virtual Memory Usage (MB)
Core i7 4770	1.3 MP (1280 x 1024)	H.264	840	28 CH	71	3595
	2 MP (1920 x 1080)		690	23 CH	73	4048
	3 MP (2048 x 1536)		380	19 CH	70	3756
	4 MP (2048 x 1944)		270	18 CH	67	3973
	5 MP (2560 x 1920)		180	18 CH	69	3872
Core i5 4670	1.3 MP (1280 x 1024)		780	26 CH	68	3568
	2 MP (1920 x 1080)		630	21 CH	68	3832
	3 MP (2048 x 1536)		360	18 CH	72	4070
	4 MP (2048 x 1944)		255	17 CH	70	3961
	5 MP (2560 x 1920)		180	18 CH	65	4536
Core i3 4130	1.3 MP (1280 x 1024)		660	22 CH	66	2607
	2 MP (1920 x 1080)		510	17 CH	52	3540
	3 MP (2048 x 1536)		280	14 CH	36	3720
	4 MP (2048 x 1944)		195	13 CH	58	3591
	5 MP (2560 x 1920)		130	13 CH	63	3695

Table 5: Single Stream with CPU Decoding (4 GB / 8 GB RAM)

CPU	Resolution	Codec	Total FPS Supported	Full-Frame CH Supported	CPU Usage (%)	Virtual Memory Usage (MB)
Core i7 4770	1.3 MP (1280 x 1024)	H.264	510	17 CH	69	1930
		MJPEG	900	30 CH	72	2140
	2 MP (1920 x 1080)	H.264	360	12 CH	71	1802
		MJPEG	660	22 CH	70	1966
	3 MP (2048 x 1536)	H.264	200	10 CH	68	1795
		MJPEG	480	24 CH	69	2138
	4 MP (2048 x 1944)	H.264	135	9 CH	69	1797
		MJPEG	360	24 CH	72	2201
	5 MP (2560 x 1920)	H.264	100	10 CH	71	1957
		MJPEG	320	32 CH	72	2595
Core i5 4670	1.3 MP (1280 x 1024)	H.264	450	15 CH	68	1597
		MJPEG	630	21 CH	72	1623
	2 MP (1920 x 1080)	H.264	300	10 CH	73	1483
		MJPEG	420	14 CH	71	1457
	3 MP (2048 x 1536)	H.264	160	8 CH	67	1420
		MJPEG	320	16 CH	72	1592
	4 MP (2048 x 1944)	H.264	120	8 CH	71	1475
		MJPEG	225	15 CH	73	1592
	5 MP (2560 x 1920)	H.264	80	8 CH	67	1582
		MJPEG	210	21 CH	69	1904
Core i3 4130	1.3 MP (1280 x 1024)	H.264	270	9 CH	63	1361
		MJPEG	420	14 CH	69	1415
	2 MP (1920 x 1080)	H.264	180	6 CH	64	1279
		MJPEG	300	10 CH	70	1352
	3 MP (2048 x 1536)	H.264	100	5 CH	57	1278
		MJPEG	220	11 CH	69	1428
	4 MP (2048 x 1944)	H.264	75	5 CH	66	1323
		MJPEG	165	11 CH	72	1459
	5 MP (2560 x 1920)	H.264	50	5 CH	60	1373
		MJPEG	160	16 CH	72	1682

1.1 Test Environment

The total frame rate and number of full-frame channels supported based on CPU usage were obtained using the following bitrate and test PC.

Bitrate used for the test		
	H.264	MJPEG
1.3 MP (1280 x 1024)	5.05 Mbit/s	32.36 Mbit/s
2 MP (1920 x 1080)	7.01 Mbit/s	44.96 Mbit/s
3 MP (2048 x 1536)	10.48 Mbit/s	38.73 Mbit/s
4 MP (2048 x 1944)	11.65 Mbit/s	41.50 Mbit/s
5 MP (2560 x 1920)	16.48 Mbit/s	30.48 Mbit/s

PC specifications used for the test	
Test Computer 1	
OS	64-bit Windows 7
Motherboard	ASUS H87-Pro
CPU	Core i7 4770 3.40 GHz
Chipset	Intel Haswell
RAM	For tables 1, 3, 5: DDR3 1333 4 GB x 2 For tables 2, 4, 5: DDR3 1333 2 GB x 2
VGA	Intel HD Graphics 4600
Test Computer 2	
OS	64-bit Windows 7
Motherboard	Gigabyte GA-B85-HD3
CPU	Core i5 4670 3.40 GHz
Chipset	Intel Haswell
RAM	For tables 1, 3, 5: DDR3 1333 4 GB x 2 For tables 2, 4, 5: DDR3 1333 2 GB x 2
VGA	Intel HD Graphics 4600
Test Computer 3	
OS	64-bit Windows 7
Motherboard	Gigabyte GA-B85-HD3
CPU	Core i3 4130 3.40 GHz
Chipset	Intel Haswell
RAM	For tables 1, 3, 5: DDR3 1333 4 GB x 2 For tables 2, 4, 5: DDR3 1333 2 GB x 2
VGA	Intel HD Graphics 4600

2. Workarounds to Increase Total Frame Rates

If your CPU capacity is lower than **Core i7**, **Core i5** or **Core i3** but wish to reach high frame rates, you can use dual streams or sacrifice the resolution as a workaround.

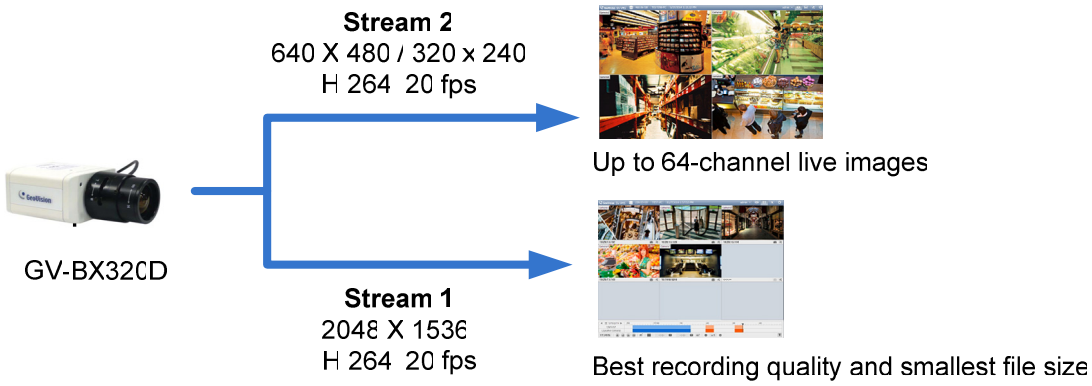
2.1 Using Dual Streams

If you are unable to reach the desired frame rate, it is highly suggested to use the dual-stream function if available on your IP device.

GeoVision IP Cameras feature dual streams, capable of delivering two video streams in different resolution, codec and frame rate. Using dual streams, you can lower the resolution and codec for live images, but set the recording stream to mega pixel resolution for high quality recording and to H.264 codec for small file size.

Here we use GV-BX320D as an example. You can set Stream 1 and Stream 2 to different resolution.

- **Stream 1 (recording) settings:** Select 2048 x 1536 (3 MP) resolution for the best recording quality, and select H.264 codec for the smallest file size.
- **Stream 2 (live view) settings:** Select either 640 x 480 (VGA) or 320 x 240 (CIF) resolution depending on your CPU capacity. Higher resolution requires more CPU resource.



2.2 Decreasing Resolution

If your IP device does not support the dual-stream function, you may consider decreasing the image resolution. Decreasing the image resolution can reduce CPU usage and allows the GV-VMS to achieve higher frame rates.

3. Hard Disk Limitations

The hard disk performance can greatly affect GV-VMS's performance. When the size of transmitted data is large and exceeds the transfer rate of a hard disk, you may encounter problems such as time gaps, frame dropping and high hard disk failure rate . To avoid these problems and have the maximum performance out of GV-VMS, you should note the total recording frame rate that you can assign to a single hard disk, as listed below:

Frame rate limit in a single hard disk

Video Resolution	H.264		MJPEG	
	Frame Rate	Bit Rate	Frame Rate	Bit Rate
1.3 MP (1280 x 1024)	660 fps	5.05 Mbit/s	300 fps	32.26 Mbit/s
2 MP (1920 x 1080)	660 fps	7.01 Mbit/s	210 fps	44.93 Mbit/s
3 MP (2048 x 1536)	440 fps	10.48 Mbit/s	140 fps	38.67 Mbit/s
4 MP (2048 x 1944)	330 fps	11.65 Mbit/s	105 fps	40.53 Mbit/s
5 MP (2560 x 1920)	220 fps	16.48 Mbit/s	80 fps	30.4 Mbit/s

The frame rate limit is based on the resolution and codec of video sources. The higher video resolution, the lower frame rate you can assign to a single hard disk. In other words, the higher frame rate you wish to record, the more hard disks you need to install on your system.

For example, if you want to connect 64 units of GV-FD5300 and record at 5 megapixel resolution, you will need at least 4 hard disks. The calculation and hard disk assignments are given below

Spec. of GV-FD5300	10 FPS at 5 MP with H.264
Frame rate limit for one hard disk	220 FPS at 5 MP with H.264
No. of hard disks required for recording	3 hard disks (10 FPS x 64 units) / 220 FPS
Hard disk assignments	1st hard disk for Windows OS 2nd hard disk for recording channels 1-22 3rd hard disk for recording channels 23-43 4th hard disk for recording channels 44-64

In terms of codec, H.264 has much better compression ratio and much smaller file size than MJPEG. Therefore, the video streaming compressed with H.264 has much lower bitrate and thus allows more frame rate.

Note: It is strongly recommended to use separate hard disks for installing Windows operating system and for storing recorded files.

3.1 Test Environment for Hard Disk Limitations

The Hard Disk Limitations were obtained using the following bitrate and hard disks.

Bitrate used for the test of hard disk limit		
	H.264	MJPEG
1.3 MP (1280 x 1024)	5.05 Mbit/s	32.26 Mbit/s
2 MP (1920 x 1080)	7.01 Mbit/s	44.93 Mbit/s
3 MP (2048 x 1536)	10.48 Mbit/s	38.67 Mbit/s
4 MP (2048 x 1944)	11.65 Mbit/s	40.53 Mbit/s
5 MP (2560 x 1920)	16.48 Mbit/s	30.4 Mbit/s

Type of hard disk used for testing hard disk limit
WD Caviar Black, WD1002FAEX (SATA 6 GB/s), 64 MB cache For details, see http://wdc.com/global/products/specs/?driveID=792&language=1