Vicon Valerus version 18.2 Performance Guide

General

With the release of the Valerus VMS, Vicon has introduced and offers a flexible and powerful display performance algorithm. Valerus allows using multiple monitors and maximizing the number of display layouts, but this requires proper design and configuration so that the system's capabilities are not exceeded. This document describes the factors that need to be considered and the design criteria that should be focused on when determining the quantity and configuration of Valerus Client PCs needed to support a required camera's layout.

This document will use the term Client PC for all PC configurations and monitor outputs.

Various Factors to Consider

When trying to determine how many cameras can be displayed on a certain monitor and how many Client PCs will be required to achieve such a display, a few parameters need to be considered:

- ### Frame Rate
  The expected frame rate displayed for each camera depends on the video source frame rate as well as the size of the frames, based on compression as explained below.
- ### Resolution
  The higher the picture resolution, the harder the display task becomes (requires more CPU).
- ### Compression
  The image compression is also important and the higher the compression of the video is, the more resources it will require from the PC to decompress them.
- ### Codec
  With the introduction of H.265, an additional factor has been introduced. The decompression and display of H.265 based video is much more CPU intensive than with H.264.

A combination of all these factors will result in the number of cameras that can be displayed across an array of monitors and Client PCs. Adding additional cameras will cause a reduction in FPS and, at a certain point, will bring the Client PC to its maximum resources. The numbers that are shown in this document are test results and not a theoretical calculation.

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The Different System Layouts

There are a few ways in which Client PCs systems are being deployed (2 and 4 monitors from Vicon). The main system layouts have been tested to provide as much information as possible.
In each test, a different video source type was used in order to measure the maximum FPS that can be displayed before the system reached its resource limit.

System Resources and Performance Monitoring

The Client PCs are built using the optimal hardware and software for their task. The different PC components such as the CPU, memory, display card and motherboard speed are working together to display as many frames per second as possible. When these combined resources reach a certain level, they cannot process any more data and might even reach a critical point at which the whole PC will stop working.

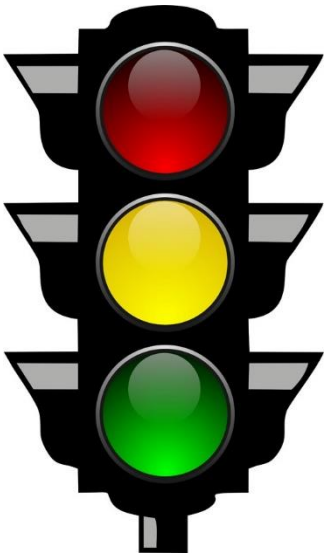
To prevent the systems from crashing as a result of a resource overload, Valerus products have built-in limitations, as well as a dynamic performance monitoring mechanism, that protect it and notifies the user that the system is being pushed over its capabilities.

This mechanism can be looked at as a virtual traffic light. (**There is no actual traffic light indication on the application; the picture below is for clarification only!**)

Resource overload

High resources

Normal operating range



Normal Operating Level – “Green Light”

As long as the Client PC has the combined resources to keep displaying video, it is working in the virtual “green light zone”. The recommended camera numbers provided in this document are meant to keep it in that zone, and additional cameras may be added until the next level is reached.

High Resources Level – “Yellow Light”

The Client PC built-in monitoring system senses that the combined resources utilization is getting to a level that might cause display issues. The system will automatically switch the display to show only the reference frames (also known as I or Intra frames) or a one frame per second, in order to reduce the load. This will result in a slow and jerky display for some or all camera, due to the low FPS, but will not harm recording. Once resources are made available, the display will return to the normal operating level.

Resource Overload Level – “Red Light”

The Client PC built-in monitoring system no longer can cope with the video display load by reducing the fps to the I frame and will get very slow to respond, up to even a browser crash. This is a critical resource overuse and needs to be corrected by lowering the display mode. This will not harm the recording on the NVR.

Important Notes:

- The monitoring mechanism is dynamic and depends on several factors, some dynamic themselves (for example, some cameras will have more motion during the day than at night). Designing the system according to the rules listed in this document will help avoid this mechanism from kicking in and will keep the system functioning in the normal operating level.
- As explained, there is no actual traffic light indicator (this is a virtual concept) on the user interface; it is an internal monitoring mechanism.
- As long as the Client PC used is not also the NVR, the slowdown in display does not impact the recording. If the Client is running on the NVR itself, reaching a resource overload might impact recording also (gaps).

Guidelines for Maximum Performance

As explained above, the Client PC performance varies significantly between different sources and the different parameters each offers. There are a few ways that can help to maximize the performance when using specific features offered by some cameras:

Take advantage of camera dual-streaming

In cameras that offers multiple video stream configurations (most new open standard cameras offer dual streaming), the camera setting will typically have a stream for the highest resolution (for example 2MP) and a second one with a lower resolution (like D1). This means that display of multiple cameras (4, 9, 16, etc.) can use the second, lower resolution stream and save on display resources instead of pulling the first HD stream, which will require much more. Additionally, in a screen layout that is showing multiple cameras, the picture size in pixels is fairly small, so there is no value in using an HD image.

When setting up the camera streams in Valerus, ensure a second stream (640x480 or even 320 x 240) is defined, so when Client PC displays this camera in a split screen, it will automatically identify that the size of the display tile in pixels can be fully used by the lower resolution stream and save resources. If a camera is called up in single mode, VMDC will use the first, high resolution stream to maximize the quality. This way the system will be able to support many more cameras.

The display behavior described above is automatic (no set up needed except having the two streams) and does not affect the recording resolution (as the camera can still send the first high-resolution stream for recording). This behavior is based on selecting the closest resolution stream higher than the tile resolution.

Consider actual resolution in your calculations

In cameras that do offer the lower resolution option as described above, you should consider this in the screen layout accordingly. When using cameras that offer dual-streaming, understand the behavior and consider which layout is going to be used so the calculation can be made accordingly.

For example, a 2MP camera in single view will provide the whole 2MP picture, but if put in a quad or higher split screen, it can provide the lower resolution picture, such as D1. This means that when calculating how many cameras the system can display, you might be able to use the D1 camera count rather than the 2MP if you know it is always going to be displayed in a split screen.

This dynamic capability of the Client PC to select the most optimal stream by the display tile size is dynamic and is fully compatible with various monitor resolutions, including 4K. It is important to remember that when using 4K resolution, each video tile is now of a higher resolution, so the 2nd stream needs to be adjusted accordingly.

Important note!

When using the 360° (hemispheric) cameras and performing dewarp in the VMS, the stream displayed when in single camera view is the highest and in split screen typically the lower one (if it exists), including when dewarp is performed or preset is called.

Control the FPS

As mentioned earlier, frame rate is a critical factor in the display process; the lower the FPS is for the cameras, the more of them the Client PC will be able to display. This is true in any camera that allows controlling FPS and provides an option to lower the FPS per stream and, by that, increase the number of cameras that can be displayed.

Adding Hardware

Remember that the limitation is mainly based on the performance of the Client PC that handles display; you can always add a Client PC if you notice limitations in displaying what is needed and move some of the display to it. This of course will add monitors but will ensure that the system as a whole can process and display the required number and quality of cameras.

Performance Specification

All the performance guidelines below are based on the current hardware specifications for Client PCs hardware and on 64 bit Windows 7 or Windows 10 operating system. If older hardware or 32 bit operating system is being used, it is expected to perform slightly below this spec.

The Client PC Bandwidth Use

- Bandwidth to and from the management Client PC: The Client PC has a 1Gbps network card and is expected to connect to a compatible port on a switch. Using 100Mpbs network will cause slowing down and display issues.

- If the performance guide is followed, it is very unlikely the recommended 700Mbps (70% of the maximum 1Gbps) bandwidth will be exceeded.

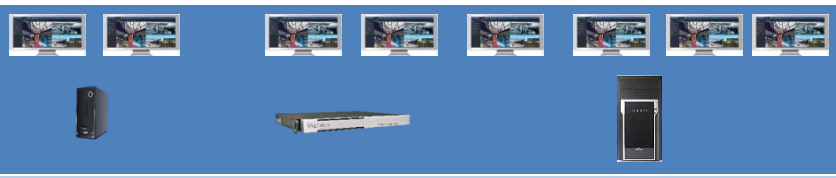
Notes:

1. The Valerus Mini PC is not part of this guide. See VLR-MINI datasheet for further information.
2. Current 12MP camera tested supports up to 20fps.
3. Same numbers seen when using 4K monitors.
4. When using 360° cameras with Valerus in VMS dewarp, it uses more CPU than non-dewarped ones. Consider a 20% reduction from the number in the table.

Valerus Client PCs with i5 based processor

Resolution	Maximum Cameras Across All Video Monitors					
	H.264-30fps	H.265-30fps	H.264-15fps	H.265-15fps	H.264-7fps	H.265-7fps
1 CIF	40	20	50	30	60	40
D1	24	12	37	22	60	40
800x600	14	8	20	13	38	22
1280x720 (1MP)	15	7	25	15	33	25
1280x1024 (1.3MP)	13	6	22	12	28	21
1920x1080 (2MP)	10	4	16	9	20	15
1600x1200 (2MP)	10	4	16	9	20	15
2048x1536 (3MP)	6	3	13	6	18	10
2592x1520 (4MP)	4	2	10	5	14	8
2600x1950 (5MP)	4	2	7	4	10	8
3072x2048 (6MP)	4	1	6	3	8	5
3840x2160 (8MP/4K)	3	1	6	2	7	3
4000x3000 (12MP)	N.A.	N.A.	4	1	5	2

Valerus Client PCs with i7 based processor



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1600x1200 (2MP)	13	5	22	12	40	20
2048x1536 (3MP)	11	3	19	8	36	15
2592x1520 (4MP)	5	3	10	6	17	12
2600x1950 (5MP)	6	2	9	4	14	7
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Following the guidelines in this document will help to ensure the system will always run in its optimal state and not switch into a high or critical resource state, which will slow down the video.