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Camera to NVR Ratio for Recording

General Information

An important part in any system design is specifying the correct number of NVRs to support the required number of cameras. Optimizing the use of a system's NVRs will not only save money but will also ensure proper operation of the system and protect the recorded data.

Factors in NVR calculations

When calculating the number of cameras that can be recorded by a single NVR, a few factors must be considered:

1. **Video resolution** – the higher the recorded resolution, the lower the total number of cameras the NVR can support. This factor has become increasingly relevant as megapixel cameras have become commonplace.
2. **Frame rate** – the higher the recorded fps is, the lower the total number of cameras the NVR will support.
3. **Target hard drive** – An NVR writing to a RAID unit (internal or external) will support more cameras than one writing to a direct internal drive.
4. **Video compression** – Cameras that use MJEPG based compression produce much higher bandwidth than those that use MPEG or H.264 based compression and, as a result, put more demand on the NVR.
5. **Scene activity** – Scene-by-scene, the amount of motion the camera is recording, will impact the overall bandwidth and picture sizes, and will influence the NVR's recording

Combined, these factors create an ever-changing stream of data from a system's many cameras into the NVR and from it to the hard drives. In addition, the NVR and drives are also required to quickly read the data back, sending it to anyone requesting video playback. As a result a safety margin must be built into the NVRs maximum capabilities, allowing for higher than anticipated demands and ensuring reliable, continues operation under a wide range of sometimes unpredictable circumstances.

NVR Hardware Requirements

ViconNet software has been designed to make extremely efficient use of the NVR's resources. As result, the hardware requirements for the NVRs running ViconNet are very low compared to NVRs running other industry-standard VMS software. This translates to a cost savings for Vicon customers, both in the purchase of initial NVRs as well as when additional units may be required as part of a system expansion.

While customers may consider purchasing NVR hardware that exceeds the performance requirements of ViconNet specifications, it might not be a valuable investment. The average cost savings for each additional camera that might be added to a more powerful NVR (fairly low addition) would most likely exceed the additional cost of purchasing this NVR.

Written by Guy Arazi

Design Assumptions:

- The camera counts are for an NVR dedicated to recording!
  The NVR is not configured as the system Nucleus and is not running any local video display.
- The scene activity used for these estimates is a typical mall or hotel lobby type activity (~50% motion)
- The compression method these estimates are based on is MPEG-4 / H.264, if JPEG is used, the numbers will be up to 25% lower than the ones currently listed
- When connected to an external RAID (typically via iSCSI SAN), the maximum number of NVRs or DVRs sharing a single RAID is 4
- The numbers listed for RAID drives cover both internal RAID (such as Shadow NVR) and external ones such as DAS or SAN

If your system is significantly different in its characteristics than the assumptions above, please be sure to make adjustment to you calculations.

Constant Bit Rate vs. Variable Bit Rate:

The typical IP cameras (and encoders) today offer a selection between using VBR and CBR as the method to control the stream of data from the camera. The advantage in using **CBR** is the known bandwidth at all-time which allows a simple calculation of the storage and takes away the dependency on the motion but might lower the picture quality at times when the motion is very high. On the other hand **VBR** which allows the bandwidth to adjust according to motion does not sacrifice quality but will require more storage at times when the motion is very high.

This table shows typically recommended bandwidth settings for **CBR** at different resolutions and fps:

	5 FPS	10 FPS	12/15 FPS	25/30 FPS
CIF	128 Kbps	256 Kbps	384 Kbps	750 Kbps
4CIF/D1	384 Kbps	500 Kbps	750 Kbps	1500 Kbps
800 x 600	750 Kbps	1500 Kbps	2000 Kbps	3000 Kbps
1280 x 720	1000 Kbps	1250 Kbps	1750 Kbps	3500 Kbps
1280 x 1024	1000 Kbps	1500 Kbps	2000 Kbps	3800 Kbps
1920 x 1080	1250 Kbps	1500 Kbps	2500 Kbps	4000 Kbps
1600 x 1200	1250 Kbps	1500 Kbps	2500 Kbps	4000 Kbps

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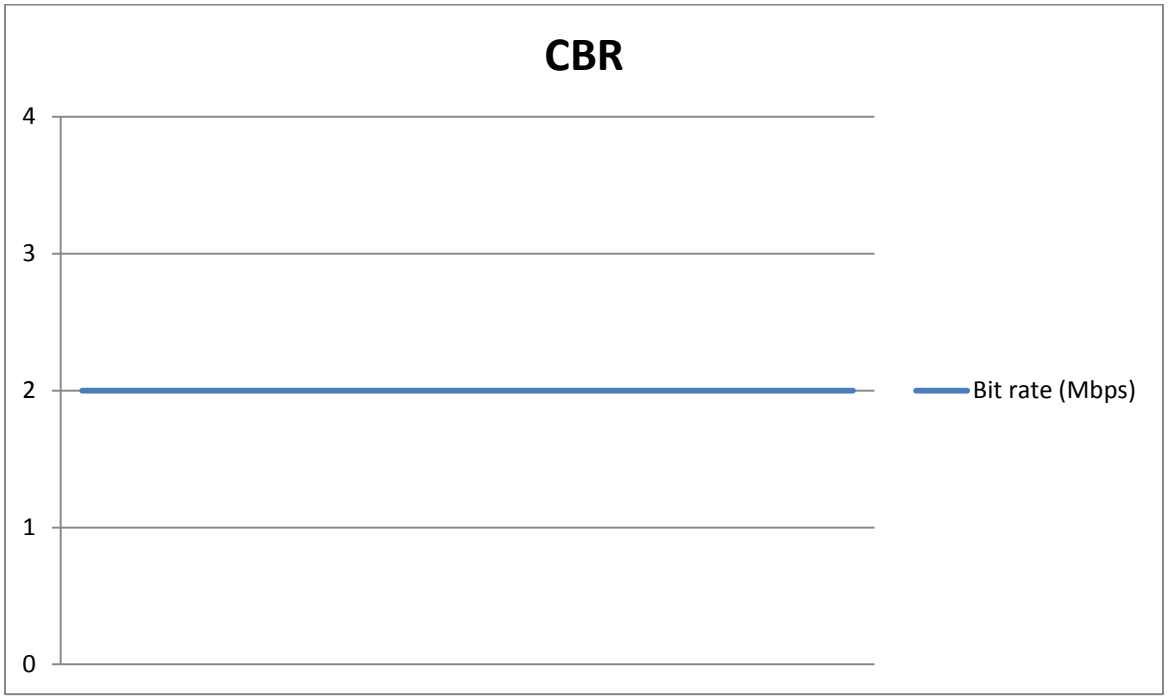
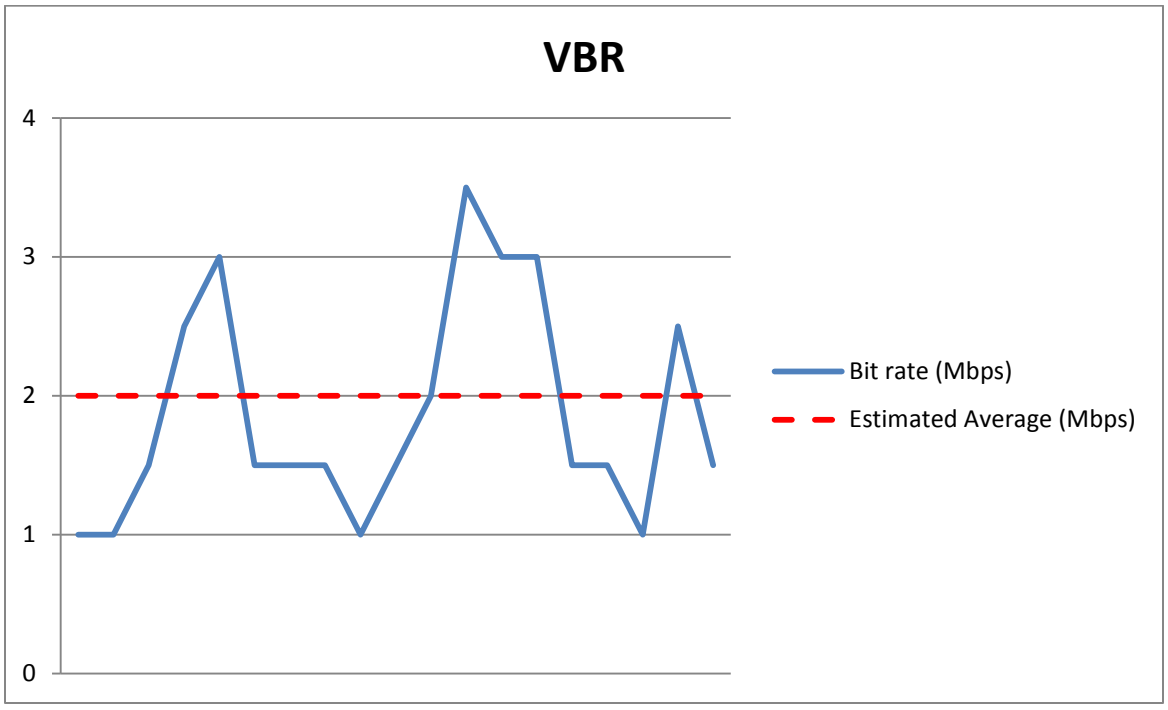
CBR and VBR graphs:

These graphs demonstrate the typical behavior of bandwidth when using CBR vs. VBR where CBR is a known constant bandwidth while VBR changes with motion but creates a certain average that can be estimated for storage purposes.





All the numbers in the tables below are based on the assumption **VBR** is used and the scene activity across cameras averages out and does not create an overly loaded scenario – or - that **CBR** is used according to the recommended values shown in the table on page 2.

When recording an unusually active scene such as a casino or moving water, or when using a much higher CBR value than the one recommended, the actual camera counts will be lower due to the additional bandwidth and processing involved.

ViconNet devices including:

Kollector DVRs, SVFT, V910IP, V910PoE, VN-855, VN-856, VN301T, KTX-4

	Recording at 25 /30 fps		Recording at 12 /15 fps		Recording at 7 fps	
Resolution / ViconNet Quality	Max cameras Internal Drive	Max Cameras RAID drive	Max cameras Internal Drive	Max Cameras RAID drive	Max cameras Internal Drive	Max Cameras RAID drive
720x480 / Q1	**35**	**50**	**40**	**55**	**50**	**70**
720x480 / Q2	**36**	**50**	**41**	**60**	**55**	**75**
720x240 / Q3	**37**	**50**	**42**	**63**	**60**	**80**
720x240 / Q4	**38**	**50**	**43**	**65**	**65**	**85**
360x240 / Q5	**39**	**50**	**44**	**75**	**65**	**90**
360x240 / Q6	**40**	**50**	**45**	**80**	**70**	**95**
360x120 / Q7	**41**	**50**	**46**	**85**	**72**	**95**
360x120 / Q8	**42**	**50**	**48**	**90**	**75**	**95**

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Vicon H.264 cameras and encoders including:

HD-PTZ, H.264-ecoder, 264, V9xx series cameras

3rd party cameras:

See web site for latest list of supported cameras and models

	Recording at 25 /30 fps		Recording at 12 /15 fps		Recording at 7 fps	
Resolution / Quality	Max cameras Internal Drive	Max Cameras RAID drive	Max cameras Internal Drive	Max Cameras RAID drive	Max cameras Internal Drive	Max Cameras RAID drive
320x240 / CIF	**38**	**50**	**42**	**70**	**60**	**80**
640x480 / 4CIF	**35**	**50**	**40**	**55**	**50**	**70**
702x480 / D1	**35**	**50**	**40**	**55**	**50**	**70**
800x600 / 0.5MP	**32**	**47**	**37**	**52**	**45**	**57**
1280x720 / 1MP	**30**	**45**	**35**	**49**	**40**	**54**
1280x1024 / 1.3MP	**29**	**42**	**31**	**45**	**32**	**49**
1920x1080 / 2MP	**24**	**35**	**28**	**38**	**31**	**42**
1600x1200 / 2MP	**24**	**35**	**28**	**38**	**31**	**42**
2048x1536 / 3MP	**22**	**32**	**24**	**35**	**27**	**38**
2288x1712 / 4MP	**19**	**28**	**21**	**31**	**23**	**34**
2600x1950 / 5MP	**17**	**25**	**19**	**27**	**21**	**29**

Note!

When using Vicons storage calculator, the numbers in the calculation might vary slightly from the numbers in the table. This is as a result of additional parameter being taken under consideration and safety margins put in for protection.

Calculation tips:

- When using cameras with multiple lenses such as Arecont's panoramic camera, count each view as a camera by itself. For example an Arecont 360 degree camera with 8MP total will be calculated as 4 x 2MP cameras for the NVR design.
- If microphones are being used, consider each microphone as 2 cameras! Audio is a constant stream and is much more sensitive to packet loss than video.
- Using Vicon's storage calculator will not only provide you with a storage estimate, it will also calculate the recommended number of NVRs with – or - without RAID.
- The storage calculator is designed to provide a safe estimate you can submit with your quotes, it is built with extra safety margins. The FPS factor in the calculator is intentionally ignored to ensure in filed changes have some buffer accounted for.
- Sometimes, using CBR will be a better choice, mainly on systems where the normal scene activity is not high and you want to ensure the video stream from the camera is always the same.
- When recording an unusually active scene such as a casino or moving water, or when using a much higher CBR value than the one recommended, the actual camera counts will be lower due to the additional bandwidth and processing involved.
- If there is a doubt regarding the parameters used on a specific design, consult Vicon's sales team to ensure your storage estimates are right.

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