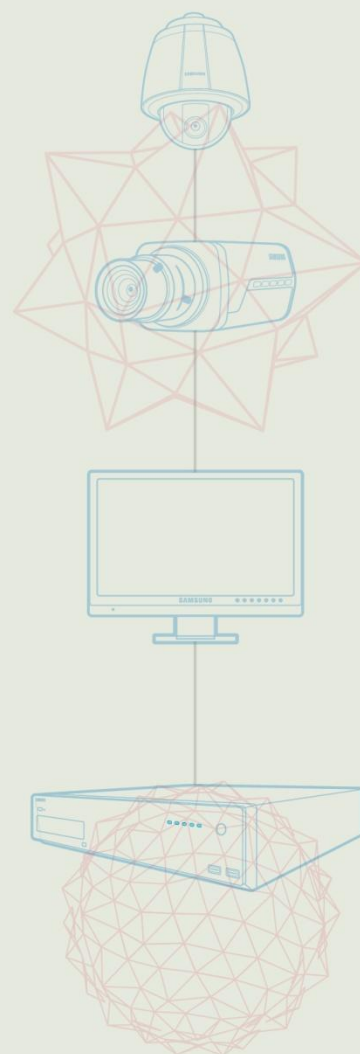


Consideration Points that may affect Video Streaming

Explains how the video configuration of a network camera affects the video streaming display and data traffic.



Overview

A network camera can provide recorded video in various types of video stream. For Samsung’s network cameras, such types defined as profiles.

Fig 1. Sample multiple profiles of a camera

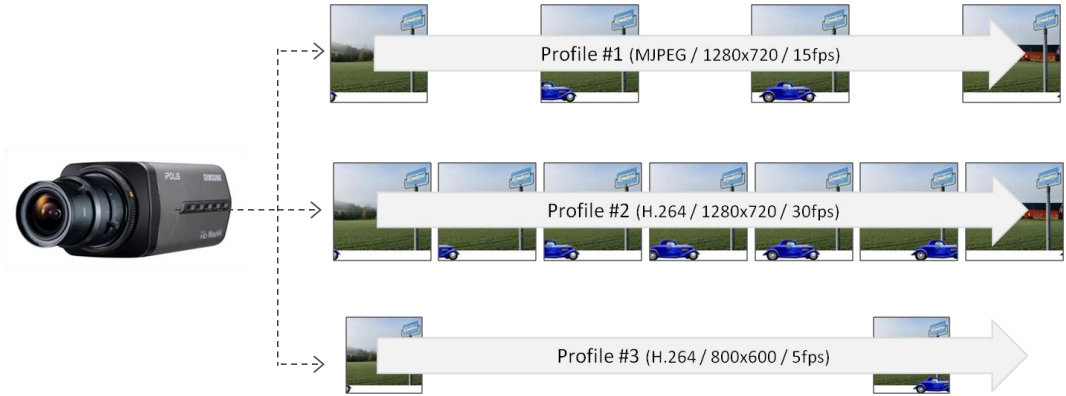


Fig 2. Video related settings page on web for 7000-series Network Cameras



You can check, create, edit and delete a camera’s profile or edit the profile’s settings in the network camera’s web viewer. In this section, the meanings and roles of each profile setting that affects video display are explained.

Codec

Raw data recorded by a camera is too large to be transmitted through a network. Recorded data is processed and compressed to a smaller sizes (encoding) and decompressed (decoding) later to be viewed properly, and the technology used in this process is called Codec. Samsung Network Camera supports different codecs MJPEG, MPEG-4 and H.264.

Fig 3. MJPEG Encoding

MJPEG

- Frame-based compression method, compresses each frame image
- Compression involves no intervention between frames

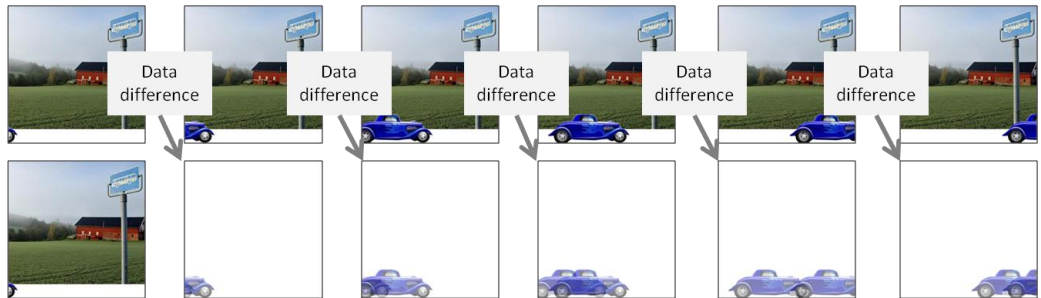


MJPEG encoding uses image compression that compresses each frame in the video stream. The resulting compressed data is bigger than other codecs but a frame loss in data transfer causes no frame-to-frame influences using this method, resulting in less damage to the streamed video.

Fig 4. H.264 Encoding

H.264

- Inter-frame difference based video compression throughout the stream



Both MPEG-4 and H.264 encodings utilize video compression that compresses only the difference between neighboring frames. By compressing only the difference between frames, the resulting compressed data is far smaller than an image compression method. Instead, recovering a frame relies on neighboring frames; reconstructed video stream is largely damaged if there is frame loss.

Fig 5. Data size comparison on MJPEG and H.264 Encodings

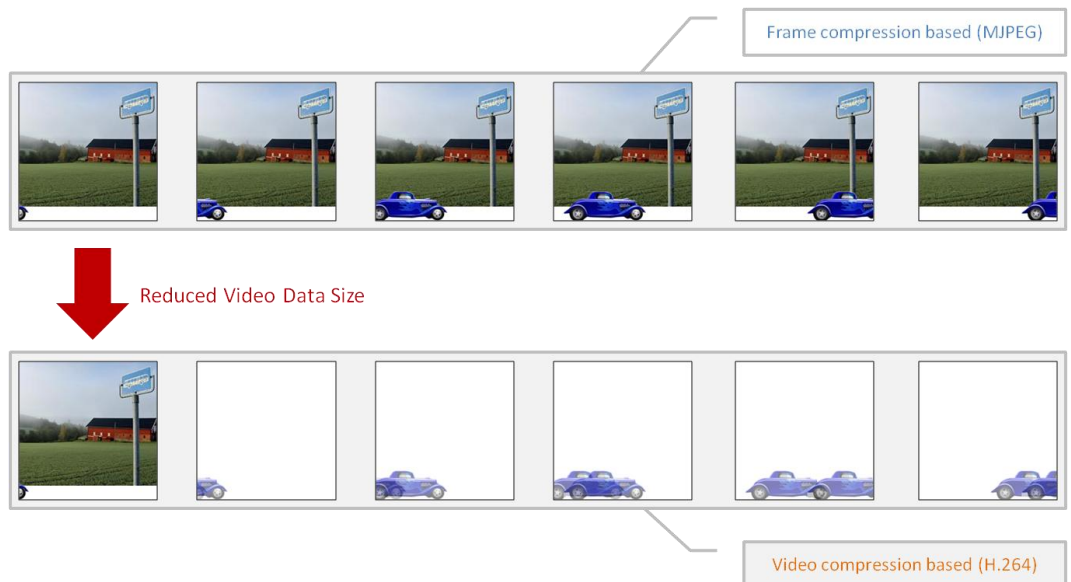
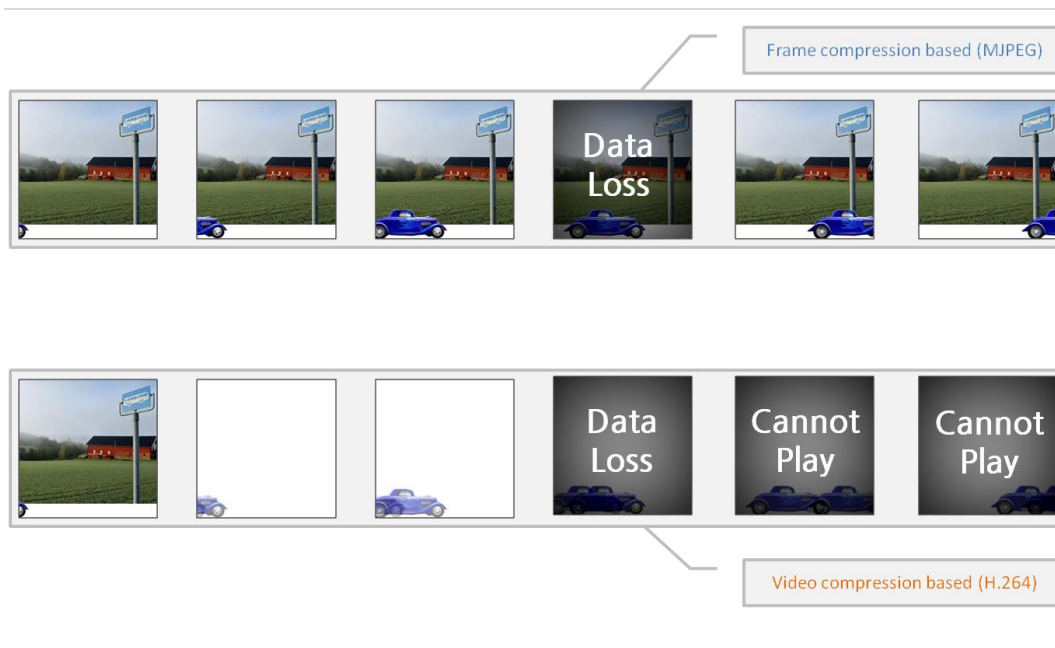


Fig 6. Data loss comparison on MJPEG and H.264 Encodings



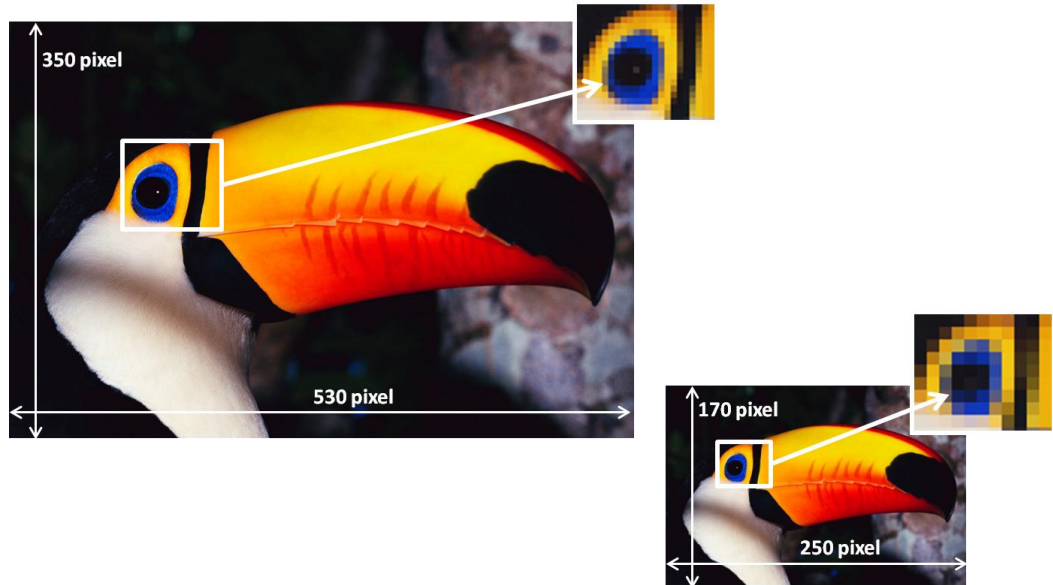
Resolution

Fig 7. Pixel, the construction block of an Image



Screen resolution is defined by how many pixels are used to display the camera's recording on a screen. If for the same image's display, the greater the number of pixels the larger image display, and more detail can be reserved if the image is enlarged. Greater resolution allows bigger and clearer images but requires more data traffic which burdens the network and requires more data storage.

Fig 8. Resolution and Sharpness



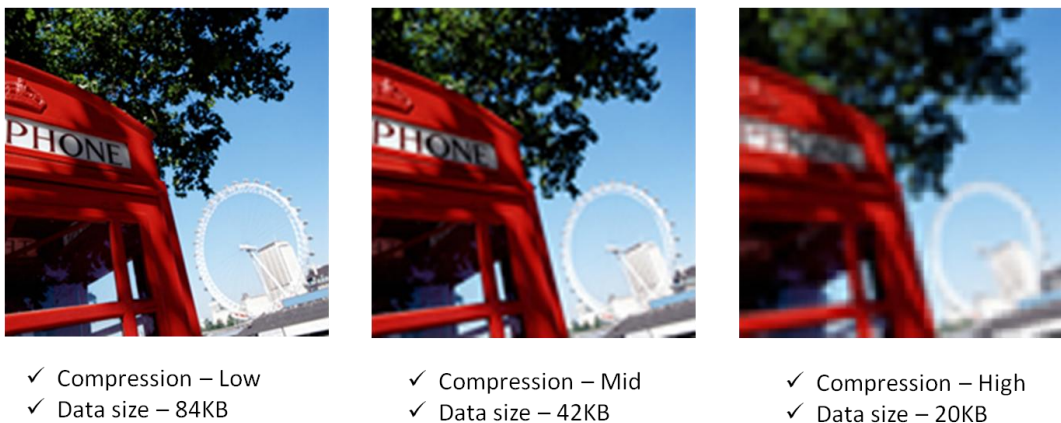
Frame Rate

Recorded video data consists of continuous flow of framed images. Frame rate is the unit of how many frame images are continuously used for a certain time period to construct a video fragment. It is denoted in fps (frames per second), and means how many images are transferred within one second. A higher frame rate allows smooth and natural video but it requires more data traffic, which burdens the network and requires more data storage.

Compression

Compression setting defines how far the video data will be compressed to save storage space. The higher compression setting has the smaller image size, however the greater data loss and deterioration of the video quality after the compression.

Fig 9. Data size and quality according to compression ratio



✓ Compression – Low
 ✓ Data size – 84KB

✓ Compression – Mid
 ✓ Data size – 42KB

✓ Compression – High
 ✓ Data size – 20KB

Bitrate Control / Target Bitrate (Max. Bitrate) / Encoding Priority

Bitrate control affects the amount of data transmission for video streaming. Samsung Network Cameras support both constant (CBR) and variable (VBR) bitrate controls.

CBR consistently maintains data transmission within a certain data size. A user can define the target bitrate which limits the maximum data transmission as desired. If transferred video data exceeds the limit in CBR configuration, the camera adjusts the data size to meet the defined limit. The encoding priority defines which part of video data should have the priority. A user can set the priority to either the frame rate or the quality. If set to the frame rate, the camera lowers the quality to meet the data size, while set to quality, frame rate is reduced so the transferred data size is less than the specified limit. A predictable and constrained data size helps stabilize the network utilization and also the storage requirements to be calculated. On the other hand, sudden variation on video size forces adjustment on frame rate or the video quality unexpectedly to meet the specified bitrate condition may produce poorer quality or unnatural movement in streamed video.

Fig 10. CBR with Frame Rate prioritized

* CBR (Constant Bit Rate)

Target bitrate : 1024Kb, Priority : Frame rate

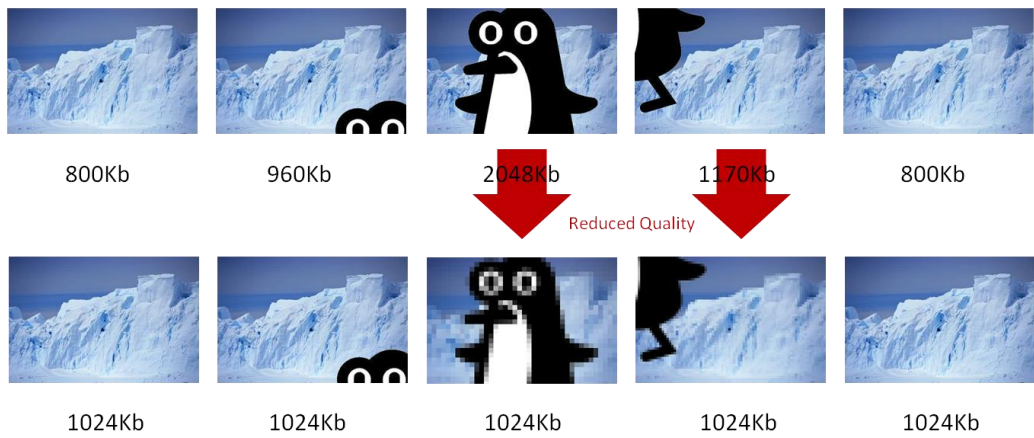
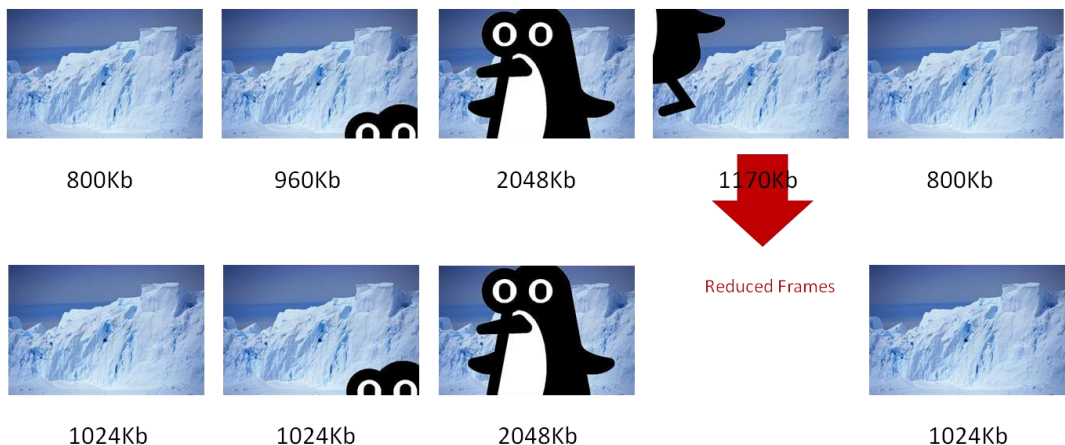


Fig 11. CBR with Quality prioritized

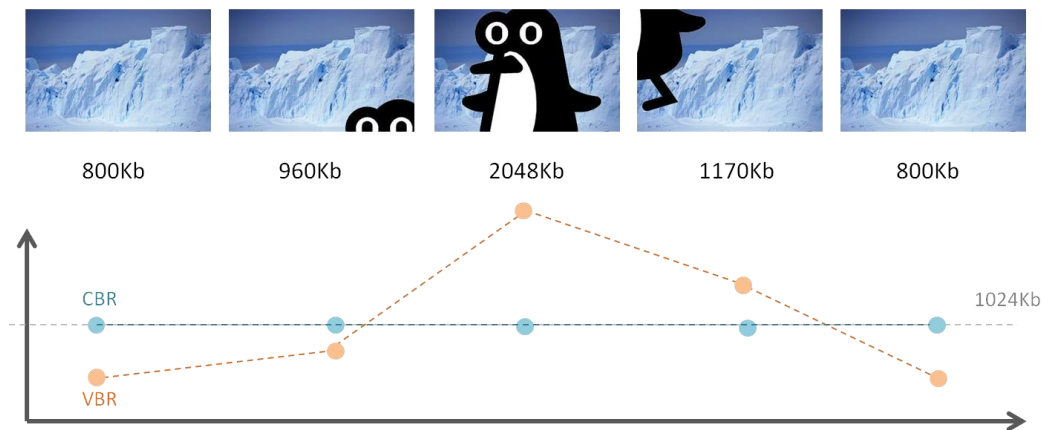
Target bitrate : 1024Kb, Priority : Quality



The VBR method maintains the video quality at a certain level during the transmission. This method controls and maintains the quality of each frame transferred regardless of the size produced, even if a frame's image size suddenly grows. As a consequence the produced data size is irregular and requires network considerations when configured. When set to VBR, you can set not to exceed a certain limit by defining the maximum bitrate to avoid unintended data traffic.

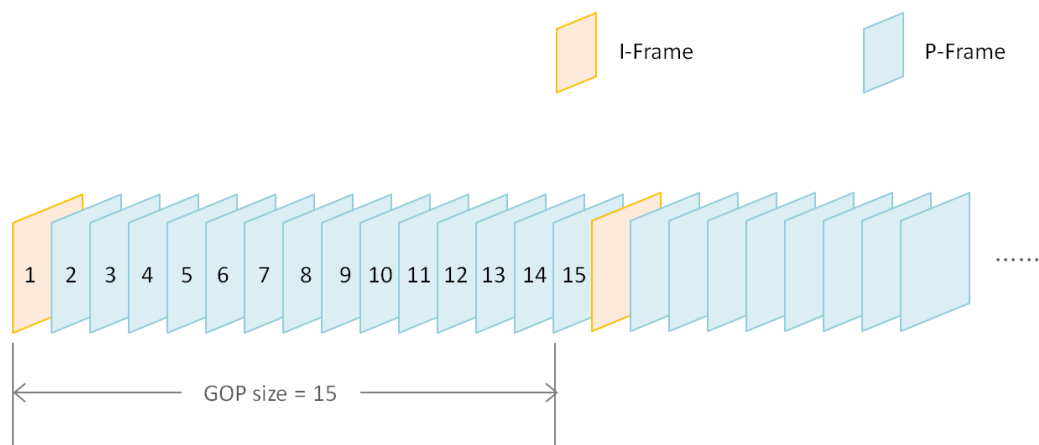
Fig 12. Data Size Comparison on CBR and VBR

* CBR vs VBR _ In terms of data size



GOP SIZE

Fig 13. GOP Size



GOP (Group Of Pictures) setting defines the number of unit frames that constitute one video fragment. With video compression codecs such as MPEG-4 and H.264, one video fragment (GOP) is consisted of one I-frame which has the full image data and P-frames having only the differences to one's prior frame. I-frame image can be displayed individually, and its size is bigger than P-frame since it has the full image data. P-frame image has only the difference to

its prior frame and cannot be displayed individually, yet its size is small enough to reduce the traffic. One I-frame and multiple P-frames consist of a GOP; a GOP size means the number of frames counting from an I-frame to the next I-frame. Video data size gets smaller as the GOP size grows. If one frame is missing in the middle of communication, the rest of P-frames cannot be shown until it finds the next I-frame.

Fig 14. Data size according to GOP size

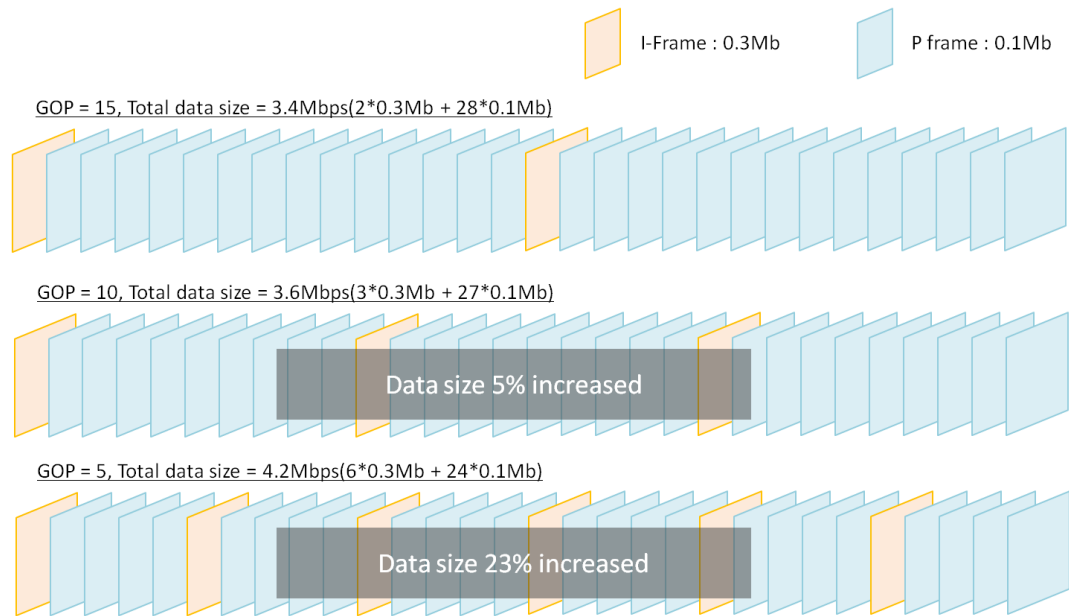
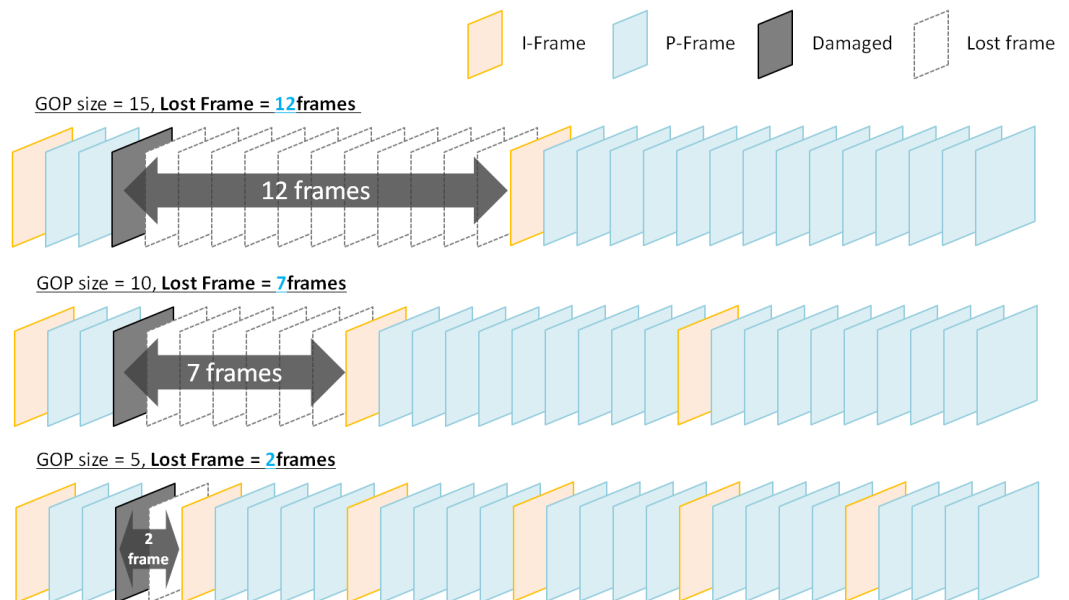


Fig 15. Frame Loss Comparison with GOP Sizes



Profile

For cameras using the H.264 as its codec, you can set the profile. A profile is a standard template which provides appropriately configured camera settings. Samsung Network Camera supports Baseline, Main and High profiles.

High profile provides better compression with higher quality compared to Baseline, but it requires more system resources to compress/uncompress and burdens the playing device.

Fig 16. H.264 Profile of Samsung Network Camera

PROFILE	TECHNOLOGY	TECH. COMPLEXITY	Quality	DATA SIZE
Baseline	Basic technology + Error tolerance , CAVLC	Low	Low	High
Main	Basic technology + High compression tech. , CAVLC + CABAC			
High	Basic technology + High compression tech. + Streaming tech. , CAVLC + CABAC	High	High	Low

ENTROPY CODING

The entropy coding is a method of lossless data compression, which utilizes relative frequency of data fragment for efficient compression. It applies low bit rate if higher probability of repeating data pattern is expected, and applies high bitrate for less probability for data processing. Samsung Network Camera supports both CAVLC (Context Adaptive Variable Length Coding) and CABAC (Context Adaptive Binary Arithmetic Coding) entropy encodings.

CAVLC utilizes simpler data processing and requires less system resources for coding, but it renders low compression ratio compared to CABAC. CAVLC is supported by all profiles, and CABAC is supported by selective profiles.

Fig 17. Entropy Codings Supported by Samsung Network Camera

METHOD	COMPRESSION	SYSTEM RESOURCE
CAVLC (Context Adaptive Variable Length Coding) ✓ Simple Processing ✓ Supported by all profiles	Low	Low
CABAC (Context Adaptive Binary Arithmetic Coding) ✓ Complex Processing ✓ Supported by some profiles	High	High

Smart Codec

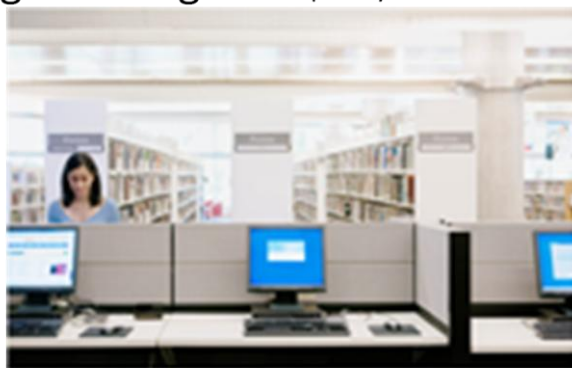
A smart codec applies a lower compression ratio to user-interested image portion for better quality while applying higher compression ratio to rest of the image. You can set to “Face Detection” for automatic recognition of human faces for clearer image, or to “Manual” to set an image area manually.

Fig 18. Image Quality with Smart Codec

Original Image high quality



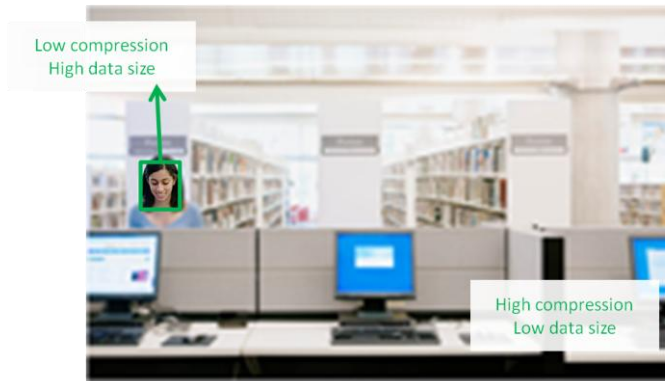
Original Image low quality



Smart Codec manual



Smart Codec face detection





SAMSUNG TECHWIN

- Functions and specifications on this document are subject to change without prior notice for improved performance and quality.

You can find more information from the "Online Tutorial" at Samsung Techwin's CCTV site.

<http://www.samsungcctv.com>