

MPEG (Motion Pictures Expert Group), developed in the 90s is one of the mostly used video and audio streaming methods. It was developed both to reduce the network load (bandwidth) when transmitting live videos via a network and to reduce the required storage space. Generally speaking, sequences of video pictures to be transmitted via a network are checked for changes within the picture.

The procedure:

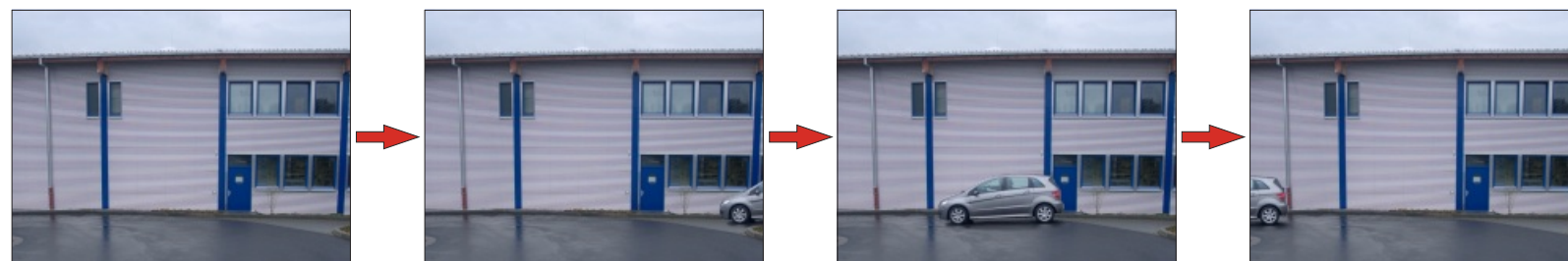
The **first** video picture that is to be transmitted is transmitted as complete reference picture, **I-Frame** - Intra-coded picture, JPEG coded (see video compression M-JPEG). For the following pictures, only those picture areas that differ from the reference picture are transmitted as difference picture. The amount of data of the following picture is reduced significantly as for example only the picture information of a moving person is transmitted and not the "static" background.

There are two kinds of difference pictures, **P-Frames** (predictive-coded pictures) and **B-Frames** (bidirectionally predictive-coded pictures).

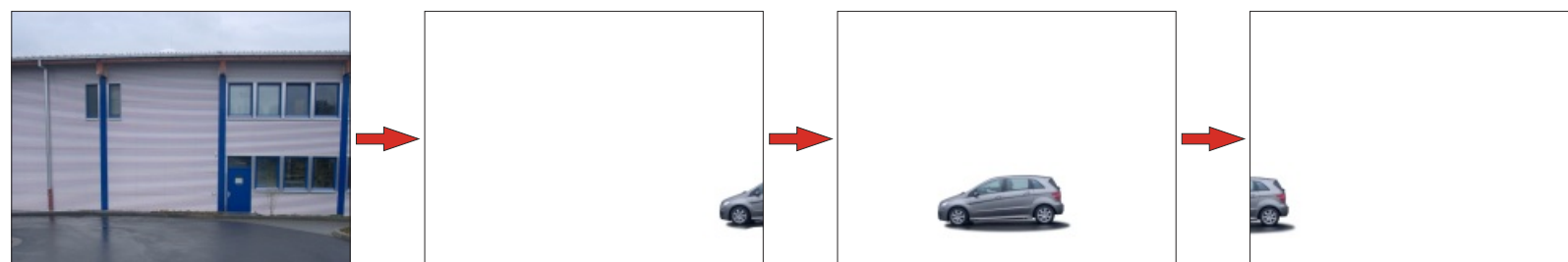
P-Frames contain difference information from a preceding I-Frame or P-Frame. **B-Frames** contain difference information from a preceding and/or following I-Frame or P-Frame. **I-Frames** are the only frames within a sequence which do not require any other frames for replaying their picture content.

A video stream consists of groups of these different frames (**GOP - group of pictures**), an I-Frame always leads this group. The order of the different frame types can be random and depends on the changes within the sequence of pictures. However, standardized MPEG2 sequences for DVDs do have a pre-defined GOP-structure. (Order of different frame types and GOP length) and constitute a compromise between picture quality and bandwidth. When replaying a live video, the individual pictures are calculated and replayed based on the picture information of the different frames.

Upon introduction of MPEG4 the previous MPEG2 standard was expanded with a variety of tools for improving the bit rate. Most of these tools have been developed particularly for the compression of studio films and are, due to the large computing power which is required, not suited for real-time applications. MPEG4 offers so-called profiles combining certain groups of tools. For each profile there are different levels available which for example define the max. bit rate or picture resolution. In multimedia applications for example, the **Simple Profile** (MPEG4SP, max. CIF picture format) and the **Advanced Simple Profile** (MPEG4ASP, max. 4CIF picture format) are often used. The utilization of certain degrees of freedom when using the compression tools allows ideal adjustments for CCTV applications.



A typical surveillance scenario: A vehicle crosses the complete camera viewing angle. The background does not change.



Simplified illustration:

A reference picture is generated. The sequence of pictures is then checked for picture areas that changed in comparison with the reference picture. Only the changed areas are used for generating difference pictures. Depending on the size of the changed picture areas, the data of the difference pictures are reduced significantly compared with the reference picture. For this example, a reduction by approx. 70% is realised. If a picture changes significantly, a new reference picture is generated automatically.

In practice, you can generally expect a data reduction by 50% in comparison to M-JPEG coded pictures when calculating the system load respectively the storage space. In certain surroundings, with few changes within the camera viewing angle, the data reduction will be significantly higher.

Compression	System load for 2CIF, 25 fields / sec.	Storage requirements 2CIF, 25 fields	System load for 4CIF, 25 frames / sec.	Storage requirements 4CIF, 25 frames
M-JPEG	approx. 5 MBit/sec.	approx. 500 KByte	approx. 10 MBit/sec.	approx. 1 MByte
MPEG4CCTV	approx. 2,5 - 3 MBit/sec.	approx. 250 - 300 KByte	approx. 5 - 6 MBit/sec.	approx. 500 - 600 KByte
MPEG4MultiMedia	approx. 1,5 - 2 MBit/sec.	approx. 150 - 200 KByte	approx. 3 - 4 MBit/sec.	approx. 300 - 400 KByte

The quality which a CCTV application (video security application) demands from a compression method is in strong contrast to the requirements of usual MPEG4 applications. While the ideal compression of a "Hollywood movie" keeps a large-capacity computer busy for many hours (DVD), only a few milliseconds are available in CCTV applications for compressing video images in real-time and to transmit them over a network. The picture quality must not suffer under this process, since "video" (from Latin "videre") does not only mean "I see" but also "**I recognize**".

GEUTEBRÜCK has developed its own special **real-time encoder** for the **GeViScope**. This reduces both the network load and the storage requirement by approximately 50% compared to M-JPEG, but does not reduce the picture quality i.e. latency times and access flexibility compared to high-quality JPEG-pictures.

MPEG4CCTV boasts specially developed MPEG4 algorithms combined with high-quality management functionalities provided by the **GeViScope** digital video system platform:

- Focus: **Flexibility**
- **Real time MPEG4 encoder** by dedicated digital signal processors (DSPs)
- CCIR / PAL, EIA / NTSC
- CCTV optimized generation of real-time frames in **GOVs (Group of Video Objects)**
- Automatic GOP length control depending on motion in the picture
- Adjustable picture formats (2CIF, CIF, QCIF)
- Continuously variable picture quality, compression rates in **VBR - Variable Bit-Rate**
- Live recording, timelapse recording
- Parallel recording and picture transmission in the network (network matrix)
- Adjustable alarm parameter sets for MPEG4CCTV, recording and network transmission
- Labelling of single pictures with event data
- Replay: Real time (live), single picture, backwards, fast forward, slow motion, zoom, event search
- Time synchronous replay of multi-channel recordings
- MPEG export, DVD compatible

MPEG4MultiMedia for security-relevant multimedia applications with GeViScope:

- Focus: **Compression efficiency**
 - **Real time MPEG4 encoder**, Multimedia Encoder Chip
 - CCIR / PAL, EIA / NTSC
 - Adjustable picture formats (4CIF, CIF, QCIF)
 - Continuously variable picture quality, compression levels in **VBR - Variable Bit-Rate** or **CBR - Constant Bit-Rate**
 - Live recording
 - Adjustable, event-controlled (alarm) parameter sets for MPEG4MultiMedia, duration of recording, picture quality
 - Replay: Real time (live), single picture, backwards, fast forward, zoom
 - MPEG export, DVD compatible
- MPEG4MultiMedia is supplied with a 4-channel interface board for GeViScope.