



Technical Notes on Digital Audio and Video Compression

1 How does digital video compression work?

Similar to network standards, a number of standards have also been developed for compression of digital images. Presently, there are a number of compression techniques, each aimed at a different application. There are two main compression methods: a complete image is transmitted every time; or, a reference image is transmitted and updated little by little until a major change requires a new reference image. When considering an upgrade to a networked surveillance system with recording capabilities, there are a number of factors to consider in determining the most appropriate compression method:

- How high a frame rate is needed?
- Are different frame rates needed during certain events or at specific times?
- What image quality is needed?
- What image resolution is needed?
- What is the available bandwidth for network transmission?

2 What is MPEG-4

MPEG-4 is an open standard, representing thousands of man-years of work shared by hundreds of companies. No one company can hope to match the technical and intellectual resources of an entire competitive market. No other technology has the potential to become as deeply developed and widely supported by multiple industries, vendors and service providers, and to be trusted by end users with their video and multimedia needs.

It is the only open standard that can address the opportunities enabled by the digital revolution: easily deploy multimedia content for any and all platforms.

MPEG-4 dramatically advances audio and video compression, enabling the distribution of content and services from low bandwidths to high-definition quality across broadcast, broadband, wireless and packaged media. MPEG-4 builds on the proven success of three fields:

- Digital television;
- Interactive graphics applications (synthetic content);
- Interactive multimedia (World Wide Web, distribution of and access to content)

3 What is ADPCM

ADPCM (Adaptive Differential Pulse Code Modulation), a form of pulse code modulation (PCM) that produces a digital signal with a lower bit rate than standard PCM. ADPCM produces a lower bit rate by recording only the difference between samples and adjusting the coding scale dynamically to accommodate large and small differences. Some applications use ADPCM to digitize a voice signal so voice and data can be transmitted simultaneously over a digital facility normally used only for one or the other.

4 What are H.263, JPEG and Motion JPEG (M-JPEG)

H.263, the next generation Hmethod, is an extended MPEG-1 or simplified MPEG-2 technique. Its focus remains bandwidth usage rather than image quality.

JPEG Joint Photographic Experts Group (ISO/IEC 10918), is the compression standard, to achieve high quality for still images, but is not used for video compression. JPEG's major advantage is that the software for decompression (and viewing) of images is included on any standard PC and web browser. JPEG is used for newspaper wire photo transmission, graphic arts, among many others.

Motion JPEG or **MJPEG** creates a digital video sequence from a series of JPEG images. JPEG/MJPEG are most appropriate when only single images are required to document a specific event like each time somebody passes through a door or for quality control monitoring of products. It is also a favorable format when bandwidth cannot be guaranteed. This is the most frequently used standard in the industry today.

5 Comparison of MPEG-4, Motion JPEG, and Wavelet

In general, MPEG-4 video compression is at least **10 TIMES** more efficient, in terms of network bandwidth usage, when it is compared to Motion JPEG (M-JPEG). Other details of video compression comparison are as follows:

		H.263 / MPEG4	JPEG / M-JPEG	Wavelet	
Basic compression scheme		Moving Video Compression	Still Video Compression	Still Video Compression	
Compression Ratio		100: 1	10: 1	20 to 30: 1	
File Size	Per Frame	2 KB/Frame	20 KB/Frame	10 KB/Frame	
	(30 Frame/sec)	60 KB/sec (480kbps)	600 KB/sec	300 KB/sec	
	(10 Frame/sec)	20 KB/sec (160kbps)	200 KB/sec	100 KB/sec	
Frames/sec	Modem (33.6Kbps)	2	0.2	0.4 to 0.6	
	ADSL (384Kbps)	24	2.4	5 to 6	
	Cable Modem (500Kbps)	30	4	8	
	Leased Line	256Kbps	16	1.6	3 to 4
		512Kbps	30	3 to 4	6 to 8
		T1 (1.544Mbps)	30	10	20
	LAN-Internet (10Mbps)	30	30	30	
Simultaneous User	10 fps, T1 (1.544Mbps)	9 to 10	1	2 to 3	
	10 fps, LAN (10Mbps)	62	6	12 to 18	
	5 fps, T1 (1.544Mbps)	18 to 20	2	4 to 6	
	5 fps, LAN (10Mbps)	100	12	24 to 36	