Tech-Topic Analysis

D. Le Gall, "MPEG: A Video Compression Standard for Multimedia Applications,"
Communications of the ACM, vol. 34, num. 4, April 1991.

          This paper was very well written and has a logical, easy to follow
structure. The paper starts by introducing why a standard was necessary for
compressing video. There were two main reasons for coming up with a standard. One
was to reduce the high cost of video compression codecs. The other was to allow
equipment from different
manufacturers to operate with each other.   Activity of Moving Picture
Experts Group (MPEG) began in 1988 with the goal of achieving a draft of a standard
by 1990.

          Next, the paper described some similar research. They started by
considering the Joint Photographic Experts Group (JPEG).
JPEG played a major role in the beginning of MPEG because both groups had originated
from the International Organization for Standardization (ISO). The research of JPEG
focused on still-image compression.
However, the research is still relevant because a video is really just a sequence of
images. Compressing a video as just a series of images is inefficient because it
does not take into account the similarities between each frame in video.

This is one of the reasons that MPEG was able to come up with such a novel way of
compressing videos. They were able to take advantage of similarities between image
frames in a video. The CCITT Expert Group on Visual Telephony had done some novel
research of their own. This is why MPEG took their research into consideration and
decided to make sure that their method and the CCITT method could be supported
simultaneously. The last relevant research considered was that of CMTT/2. There
were similarities between the solutions MPEG considered and the solution
broadcasters used for video compression. However the broadcaster's solution was for
a different problem and bandwidth.

          The paper follows by explaining the methods the committee used to make
sure the could come up with a good standard. The MPEG methodology was separated
into three phases. These phases were Requirements, Competition, and Convergence.
The Requirements phase was necessary because MPEG needed to provide enough system
design freedom and enough quality to address many applications. The competition
phase was necessary to insure a good standard that is long lived. Seventeen
companies or institutions helped or sponsored a proposal and fourteen different
methods were proposed and considered.
The purpose of the Convergence phase so that good ideas and methodology from
competition phase are joined together to have one solution.

          The next section discusses how MPEG is a generic standard in order for
it to be used in many applications. MPEG wanted their solution for video
compression to be generic so that many applications
could use it such as CD-ROMs or Digital Audio Tapes.   They the
discuss the difference between asymmetric and symmetric applications.
Symmetric uses about the same amount of the compression and decompression process.
Asymmetric examples are games and movies. A Symmetric example is video
conferencing.

          Next, the paper goes through a series of features that
MPEG wanted there solution of video compression to consist of.   They
consider a long list of features. This is a strength of the paper because MPEG was
able to consider all different ways that videos are used and come up with features
that their technique would need. They describe each of these features and explain
why they are necessary:
Random Access, Fast forward/Reverse Searches. Reverse Playback.
Audio/Visual Synchronization, Robustness to errors, Coding/Decoding Delay,
Editability, Format Flexibility, and Cost Tradeoffs.

After describing certain features their solution needs, the paper gives an overview of their compression algorithm. The algorithm MPEG chose as the solution uses two interframe coding techniques (predictive and interpolative). It relies on block based motion compensation for reduction of the temporal redundancy and transform domain-(DCT) based compression for the reduction of spatial redundancy. Since I have little background knowledge in this subject, the more elaborate details of the compression technique were hard for me to understand.

A major strength to the MPEG approach was how the algorithm only defines the syntax and the decoding process which allows manufacturers to create different encoder/decoders. This allowed for competition in manufacturers. They could create encoders based on different functionalities as long as they produce the correct MPEG syntax. Also, the manufacturers are given the freedom to implement the decoding however they choose given the manufacturers decode the compressed videos efficiently. One weakness was that it was hard for me to follow the details of the technique even with the illustrations used in the paper. The paper requires some background in compression for a complete understanding.