Digital Multimedia Standards Series

MPEG VIDEO COMPRESSION STANDARD

Joan L. Mitchell,
William B. Pennebaker,
Chad E. Fogg, and
Didier J. LeGall

Distributors for North, Central and South America:
Kluwer Academic Publishers
101 Philip Drive
Assinippi Park
Norwell, Massachusetts 02061 USA
Telephone (781) 871-6600
Fax (781) 871-6528
E-Mail <kluwer@wkap.com>

Distributors for all other countries:
Kluwer Academic Publishers Group
Distribution Centre
Post Office Box 322
3300 AH Dordrecht, THE NETHERLANDS
Telephone 31 78 6392 392
Fax 31 78 6546 474
E-Mail services@wkap.nl>

 Electronic Services <http://www.wkap.nl>

Library of Congress Cataloging-in-Publication

MPEG video : compression standard / Joan L. Mitchell...[et al.].
p. cm.
Includes bibliographical references and index.
ISBN 0-412-08771-5
1. Digital video. 2. Video compression--Standards. 3. Sound - - Recording and reproducing--Digital techniques--Standards.
4. Coding theory. I. Mitchell, Joan L.
TK6680.M64 1996 96-31124
621.388--dc20 CIP

British Library Cataloguing in Publication Data available

Fifth printing 2000 by Kluwer Academic Publishers

Cover design: Curtis Tow Graphics

Printed on acid-free paper.

Printed in the United States of America

16

MPEG Patents

Contributed by **Cliff Reader, Ph.D.**
Director Strategic Marketing
Samsung Semiconductor Inc.
San Jose, CA 95134

This chapter explores the MPEG video patent situation. The MPEG patent problem is described, a brief history is given of the effort to create a collaborative patent pool, and some statistics about MPEG video patents are summarized. A contact point is provided for more information.

16.1 MPEG patent analysis effort ○

The establishment of a standard and all the associated elements of technology does not preempt the intellectual property rights (IPR) of the inventors of those elements. As a result, implementers of the standard need a license for each piece of IPR. The purpose of the MPEG patent analysis effort has been to provide a simple, reasonably priced mechanism for implementers to license MPEG technology. Its goal is the establishment of a pool of patent holders which ideally will be able to grant a single license covering all applicable intellectual property needed to implement MPEG decoders for the mass market. The scope covers video and systems technology for the MPEG-1 standard and for the MPEG-2 standard main profile at main level (MP@ML).

16.2 ISO position ○

The ISO policy on intellectual property in standards states that all owners of intellectual property rights to technology necessary to implement a standard shall provide a statement to ISO guaranteeing that licenses to use the IPR

will be available on an equal basis to everyone at fair and reasonable rates. Should an owner not provide such a statement, ISO requires the standard to be redrafted excluding the pertinent technology, or failing that the standard is withdrawn.

Beyond this, ISO has no jurisdiction over this issue, and IPR matters are not a part of the ISO agenda.

16.3 MPEG patent problem ○

Traditionally, IPR for consumer products have been licensed by bilateral or perhaps trilateral agreements between major industrial corporations, often characterized by cross-licensing arrangements. In the case of MPEG however, the technology is too diverse. Many disciplines from different fields of engineering, different applications, different markets, and different segments of markets are involved. Owners of IPR include communication companies, semiconductor companies, consumer electronics companies, hardware systems companies, computer companies, and universities. It is very unlikely that such a group of organizations could negotiate a multilateral agreement, and even if they did, the time involved likely would stretch into years.

From an implementer's perspective, there are several problems. First, just being able to identify the holders of IPR.[1] Second, the time and expense of negotiating individual licenses with all the holders. Third, the aggregate cost of all the licenses.

The danger foreseen was that the market for MPEG-based systems could be stalled by uncertainty about the access to and cost of required IPR, and further that such a situation could be exploited by a provider of a proprietary solution.

16.4 Sponsorship of the patent effort ○

CableLabs has sponsored a patent effort as an interested user of MPEG technology [Tan92]. Baryn Futa, COO CableLabs, architected and led the program of work. A series of open-invitation meetings were initiated to confirm interest in both the licenser and licensee communities. These meetings were colocated with MPEG meetings for convenience, but were not part of the official MPEG meeting agenda. In parallel, CableLabs established a research and analysis effort to determine the exact position of IPR both legally

[1] The MPEG standards do contain annexes listing companies who have provided statements to ISO stating they may have technology relevant to implementation of the standard, and agreeing to the ISO terms and conditions. It should be understood however, that due to the limited jurisdiction of ISO, these statements have not been checked to validate relevance. The lists of these companies are provided near the end of this chapter.

and technically. CableLabs set up a team comprised of Dr. Ken Rubenstein, Esq. of the Law firm Meltzer, Lippe, Goldstein, Wolf, Schlissel & Sazer, P.C. and the author, then a private consultant. Following confirmation of interest by at least a considerable number of parties, and successful compilation of an initial list of relevant IPR, an invitation was issued by CableLabs for organizations owning IPR that they believed relevant to submit their lists of patents and join a process in good faith to establish a patent pool. This has led to substantive negotiations, with the formation of the pool expected for Fall 1996 and having a charter consistent with the ISO rules.

16.5 Historical context ○

The development of original technology had a significant influence on the process, and varied among the three parts of the standard. The critical part is video, which will be discussed here.

The original work in block transform coding started at the very end of the 1960s. The fundamental work was done up to around 1975, and then for the videoconferencing market, the work to produce practical implementations was done in the few years before and after 1980. The important point here is that the patents issued for this work have expired.

The market for image/video compression was disappointingly small, and there was a lull in the research. A few key researchers made important developments in the first half of the 1980s, and the lull was broken in the mid 1980s, building to a flood of developments in the few years around 1990, as the emergence of the H.261 standard, plus the commercial success of compact disc and then CD-ROM, indicated that for the first time, there would be a mass market for compression products. As a side note, the arrival of many newcomers in the 1980s meant that they duplicated much of the work done in the early 1970s.

16.6 Patent research and analysis program ○

The goals of the patent analysis were threefold. The first goal was to confirm that the set of patents needed to practice the standard was relatively large (greater than 20 for example). The second goal was to confirm that the patents were held by a diverse set of assignees who did not historically have a business relationship (and therefore did not have pre-existing bilateral licensing agreements). The third goal was to confirm that the assignees were themselves likely to practice the standard, and therefore were interested in enabling the market at the earliest possible date at the lowest cost, as opposed to being interested in developing a major revenue stream from royalties on the patents.

A definition was made for the purposes of organizing the search. Note that this definition was independent of any definition subsequently made by the members of the patent pool, it merely served to direct the background investigation. The basic definition was "those patents essential to practice the art". This was interpreted to mean several things in the context of the standard. It covers elements of technology that are:

- Normative for implementing decoders
- Normative for constructing bitstreams
- Essential within encoders for making bitstreams

In addition, other categories were defined for relevant, but not essential IPR:

- Encoder technology, especially for smart encoders
- Pre- and postprocessing technology
- Specific hardware implementation techniques

No attempt was made to evaluate the validity of the claimed patents. The patents were taken at face value.

For the searches, the net was cast very wide. Technologies were searched that were not a part of the standard, but which used common elements of technology and therefore potentially would contain relevant patents. For example, TV standards converters started using motion compensation some years before the MPEG effort was started.

16.7 Results of the video patent analysis ◑

Table 16.1 summarizes the results of the video patent analysis. The number of abstracts reviewed was more than 6,000 of which somewhat more than 10% were judged relevant to MPEG. These patents were reviewed in full. Of those, about 30 were judged essential, about 200 were related to MPEG, but not essential, and about 100 concerned hardware implementation of MPEG technology.

16.8 Patent holders in MPEG video standards ○

MPEG-1 Video (ISO/IEC 11172-2) Annex F (List of Patent Holders) states that information about patents can be obtained from the following companies (and provides their addresses): AT&T (USA), Aware (USA), Bellcore

Number of abstracts	>6,000
Number of patents	>750
European	≈ 25%
Asian	≈ 45%
American	≈ 30%
Number of assignees	115
Number essential	≈ 30
Number nonessential (total)	≈ 200
Pre/postprocessing	≈ 20
Smart encoder (subtotal)	≈ 150
Rate-buffer/quantizer	≈ 40
Motion estimation	≈ 60
Number hardware designs (total)	≈ 100
DCT	≈ 30
VLC decoders	≈ 30
System architecture	≈ 10

Table 16.1: Results of video patent analysis.

(USA), The British Broadcasting Corporation (UK), British Telecommunications (UK), CCETT (France), CNET (France), Compression Labs, Inc (USA), CSELT (Italy), CompuSonics Corp. (USA), Daimler Benz AG (Germany), Dornier GmbH (Germany), Fraunhofer Gesselschaft zur Foerderung der Angerwandten Forschung e.V. (Germany), Hitachi Ltd (Japan), Institute fuer Rundfunktechnik Gmbh (Germany), International Business Machines Corp. (USA), KDD Corp. (Japan), Licentia Patent-Verwaltungs-Gmbh (Germany), Massachusetts Institute of Technology (USA), Matsushita Electric Industrial Co. Ltd (Japan), Mitsusbishi Electric Corp. (Japan), NEC Corp (Japan), Nippon Hoso Kyokai (Japan), Philips Electronics NV (The Netherlands), Pioneer Electronic Corp. (Japan), Ricoh Co., Ltd. (Japan), Schawartz Engineering & Design (USA), Sony Corp. (Japan), Symbionics (UK), Telefunken Fernseh un Rundfunk GmbH (Germany), Thomson Consumer Electronis (France), Toppan Printing Co., Ltd. (Japan), Toshiba Corp. (Japan), and Victor Company of Japan Ltd. (Japan). Seven countries with six native languages are represented in the MPEG-1 video list. The worldwide distribution of patent holders is not surprising since technical experts from many companies create ISO international standards.

MPEG-2 Video (ISO/IEC 13818-2) Annex F (Patent Statements) also states that information regarding patents can be obtained from a list of companies who have submitted at least informal statements. In addition to

many of the MPEG-1 listed companies, the list adds Belgian Science Policy Office, BOSCH, Columbia University, David Sarnoff Research Center, Deutsche Thomson-Brandt GmbH, Fujitsu Ltd, GC Technology Corp., General Instruments, Goldstar Co. Ltd., IRT, Nippon Telegraph and Telephone Corp., Nokia Corp, Norwegian Telecom, OKI Electric Industry Co., Ltd., QUALCOM Inc., Royal PTT Nederland N.V., PTT Research NL, Samsung Electronics Co. Ltd., Scientific-Atlanta Inc., SHARP Corp.,Siemens AG. Texas Instruments Inc., and TV/COM International. At least two more countries are now represented in this patent holder list.

16.9 For more information ○

For more information about joining the patent pool or obtaining an MPEG license contact:

Baryn Futa, Esq., Chief Operating Officer,
Cable Television Laboratories
400 Centennial Parkway
Louisville, CO U.S.A. 80027

16.10 Acknowledgments ○

Considerable work on the analysis has been performed by Evan Kahn Esq. of Meltzer, Lippe, et al. His thoughtful, independent thinking has proven invaluable.